MACHINE DESIGN

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CONTENTS

Page

Cars of '38 Point Way to Clean-Cut Design 31
By Austin M. Wolf

Scanning the Field for Ideas 35

New Designs for Old 38
By Herbert Rosengren

Reissue Patents Correct Early Defects 41
By G. V. Woodling

Machine Uses for Tubing 43
By Guy Hubbard

Plastics in Machines—II 46
By J. Delmonte

Design to Fit Operator! 49
By Warner Seely

Design Features in New Machines 52

New Machines Indicate Design Trends 54

How Redesign Can Help Resurrect an Entire Industry . . . (Editorial) 55

Gear Meeting Papers Shed Light on Tooth Pitting 56

Topics 26
Professional Viewpoints 57
Men of Machines 58
Obituaries 60
Noteworthy Patents 62
Assets to a Bookcase 66
New Materials and Parts 70
Calendar of Meetings 88
Manufacturers Publications 95
Business Announcements 68

For Itemized Table of Contents See Page 7

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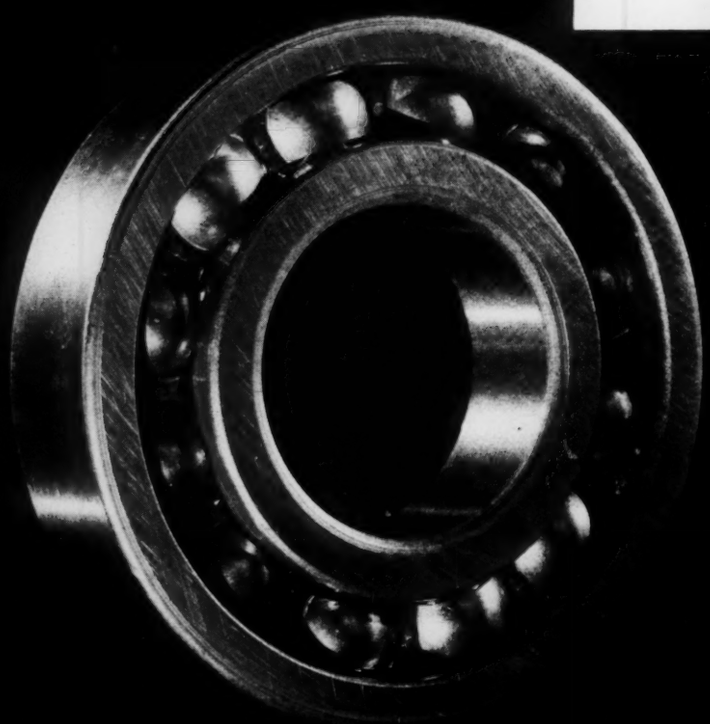

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TOPICS

INVENTING has become a business like everything else today and the casual homebody who in years past was responsible for the great majority of inventions is passing from the scene. Corporations are now employing the inventive skill of the country. In 1900 only two per cent of inventions patented were issued to corporations. Last year 19 per cent were granted to 212 domestic and foreign corporations, each of which received ten or more patents during the year. The increase was considerable compared to 1935 when corporations accounted for only 10 per cent of patents issued on inventions. The greatest number of patents received by any corporation in 1936, according to the *Journal of the Patent Office Society,* was the General Electric Company with 476. It also received the most in 1900, having over 100 in that year.

* * *

Liquor manufacturers have learned that the best way to sell their product and keep public confidence is to preach moderation in their advertising. Automobile makers are now embarking on a similar program and instead of calling attention to the speed of their vehicle, stress its safety features. In conjunction with this shrewder advertising the Automotive Safety Foundation was organized a few months ago. Supported by auto and truck manufacturers, parts and accessory makers, and finance companies, the Foundation has as its fundamental purpose the fostering of safer driving. A comprehensive program is planned for educating the public in proper highway procedure and automobile operation through various civic organizations and service clubs.

* * *

There are many who believe that the air conditioning of private homes, small offices, in fact all buildings where people live or work, is bound to come within a few years and with it a tremendous boom period. We do not like to be discouraging, but, as *Power* points out, one stumbling block stands in the way of this Utopian future: There is not enough water available and no existing pumping or sewage system in any city in the country could handle the amount of water necessary for even a small percentage of the ultimate load. Of course it is possible to use a refrigeration system where water is cooled and recirculated, but here power costs are much greater. Engineers should recognize these facts and realize that a system which depends upon a continual stream of fresh water for operation may be obsolete if many more theaters and stores are added to the present load. Our hopes of living in a delightfully cool home on hot summers are dimmed!

* * *

Several records were broken at the National Metal show held last month in Atlantic City. Not only was attendance greater than any year for the Metal show alone but the number of developments in metals surpassed any former exposition. Progress in die casting was shown to have reached the point where castings smaller than a grain of rice are no longer a novelty. Steam-tight metal hose was on display which could withstand continual flexing without failure. Perhaps the most remarkable of this year's developments was in the field of colored metals. Chromium is available now in brilliant hues which will not fade with time, and other metals can be produced in similar colors.

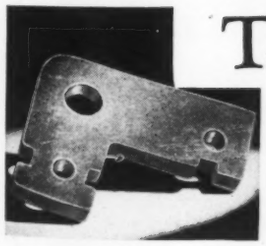
* * *

Highlights of the recent meeting of the American Gear Manufacturers association reveal the unrelenting effort that is being injected into the improvement in design and production of gearing. W. E. Sykes discussed torch hardening of gears by the oxyacetylene method. "Factors Influencing the Durability of Automobile Transmission Gears," were explained by J. O. Almen, and "Roller Tests to Determine Pitting Fatigue Strength," by Dr. Stewart Way, added to the impressive array of subjects. Two of these papers are abstracted on page 56 of this issue.

* * *

One usually thinks of specifying antifriction bearings for applications where shafts turn at high speeds or under heavy loads. The modern airplane, however, incorporates into its construction over

THIS EYE NEVER SLEEPS



TRAFFIC LIGHTS must be dependable because they control the safety of wave after wave of travelers, at cross purposes. That is one reason why *Synthane* Bakelite-laminated is used for insulating traffic light circuits—that plus *Synthane's* combination of mechanical strength, low moisture absorption and high dielectric strength. *Synthane's* great value lies in its unusually broad *combination* of physical, electrical, chemical and mechanical properties. *Synthane* is a uniformly dense, solid material. It is tough, strong and light in weight; one of the most effective dielectric materials—combining low power factor, low moisture absorption, high dielectric strength and low dielectric constant. It is chemically inert; corrosion resistant; easy to machine. The uses for *Synthane* are countless. Just as its combined properties are necessary for insulating traffic lights, so it may be of *material* assistance in the manufacture of your product. *Synthane* is often the most economical material to use. Write for "*Synthane* for Mechanical Applications", telling us in your request your requirements.

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a hundred ball and roller bearings to prevent the slightest play in control levers and give ease of movement. As late as 1928, control bearings were of the ground steel pin and bushing type, and although these were fairly satisfactory if cleaned and lubricated, dirt often entered to cause wear. By the use of sealed antifriction bearings, dirt is excluded, weight is reduced, periodic lubrication is not necessary and control movement is considerably eased. On multimotored planes, controls to each engine must be so delicately adjusted that engine RPM's will not vary more than a few revolutions with each other. Only with antifriction bearings has this precise regulation been made possible.

* * *

True to predictions made a decade ago, the electric arc welding process has been making tremendous strides in extending its fields of usefulness. The growth in the past five years is clearly shown by the National Electrical Manufacturers Association reports of electric welding wire consumption, from 18.8 millions of pounds in 1932 to 111 millions of pounds in 1936. That this progress is not all due to the general revival of industrial activity is shown by the steady increase in volume of consumption in the early thirties, before any real revival had started. A more graphic proof is the increasing amount of electrodes being used for each ingot ton of steel poured. In 1932 the figure was 1.4 lbs. of electrode for each ingot ton; in 1936 this figure had reached 2.4 pounds, an increase of 71%. In general, this growth may be ascribed to the fact that the shielded arc process makes possible a quality of weld deposit that has won engineering acceptance in nearly all the major fields of steel construction and fabrication.

* * *

Automobile color preference seems to be a matter of geography. The Chevrolet Motor Co. posts weekly on a large scale map the color preference of car buyers from which trends may be seen at a glance. Strangely enough, these trends do not vary greatly by season but they do vary by geographical location. Black is by far the preferred color in eastern and southeastern sections of the country. The far west prefers lighter grays, browns, greens and blues.

* * *

The speed with which steel rods pass through the final pass in the new continuous mills of the American Steel & Wire Co. at Joliet, Ill., is hard to believe. A No. 5 rod, nearly a mile long, comes off the final pass at a speed of 3428 feet per minute, or approximately 40 miles per hour. In the old mills which were abandoned as obsolete the speed was 1500 feet per minute. A billet advances through all 19 passes of the mill in 75 seconds. It starts with a thickness of 2 5/16 inches and leaves the mill at .207 inch. Mechanical engineers may well take pride in this achievement—it is their design of the mill which has made such a rolling operation possible.

* * *

Progress in automotive construction cannot be better illustrated than by a comparison of figures between a 1909 and 1937 model of a popular make. The earlier car weighed 3900 pounds, developed 52 horsepower at 1600 RPM and gave 8 to 9 miles on a gallon of gas. The more recent product weighs 3310 pounds, is rated at 100 horsepower at 3600 RPM and will go 17 miles on a gallon of gas. Weight per horsepower was 77 pounds in the 1909 model and 33 pounds in the 1937 auto. We have every reason to believe that this present weight ratio will be cut appreciably before another decade rolls around and performance will be such that it would have seemed miraculous to the early manufacturers.

* * *

The 50,000 vehicles that ebb and flow along the seven main arteries of London's Picadilly Circus every 12 hours will be controlled shortly by a new mechanical "system" which measures the traffic density of roads leading into the circus and regulates the traffic light timing accordingly.

* * *

In a report from one of its representatives in Japan, the United States department of commerce states that through a process recently developed in Japan, shark oil may be refined for use in airplanes. The American attache advises that the oil can be used in motors at temperatures as low as 45 degrees below zero.

* * *

A new flux has been developed for use in hard soldering, brazing and welding metals such as stainless steel, iron, copper, brass, monel metal and nickel. It is claimed that this flux acts as a solvent for metal oxides and spreads over the surface of the work to exclude air while the soldering operation is being performed. Fluxing action starts at 212 degrees Fahr. The flow point occurs at 785 degrees Fahr., and a continued flow without undue vaporization takes place up to 1600 degrees Fahr. There is no harmful toxic action and the excess flux may be washed off with water.

MACHINE DESIGN

Cars of '38

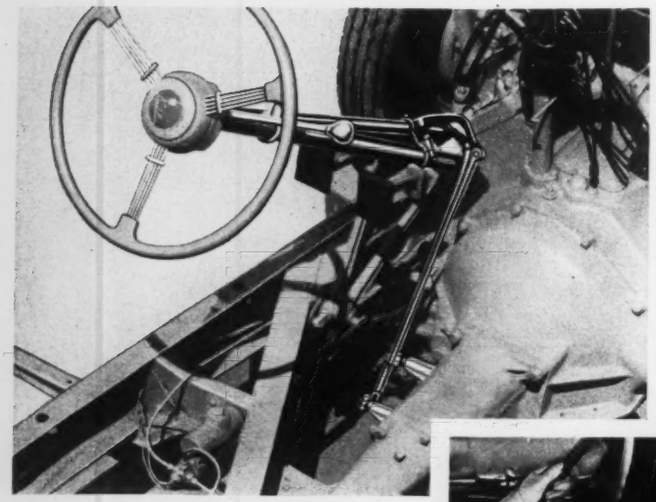
Point Way to Clean-Cut Design

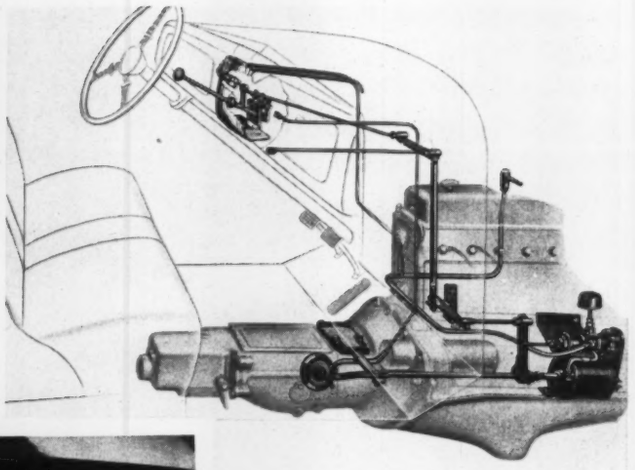
By Austin M. Wolf

NEW forms of gear shifting assume the most prominent place in development of 1938 automobile models. Many manufacturers are introducing cars in which the gear shift lever has been completely removed or remains only in a vestigial state for controlling a vacuum or hydraulic system to change the gears. Sheet metal work also shows great progress. Fenders, hoods and bodies, as depicted in *Fig.* 1, indicate the ability of the steel industry to produce deep-drawing sheets for the fabrication of one-piece members which could have been produced only by welding together two or more stampings a few years ago.

Fig. 1—Distinctive appearance is gained in the Lincoln-Zephyr, left, and the Graham, right, by merging hood and radiator lines

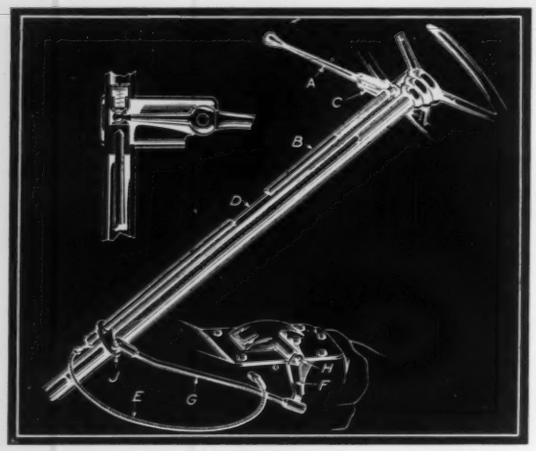
In the Cadillac and LaSalle, gear shifting is accomp-





Figs. 3, 4 and 5—Gear shifting is accomplished in the Cadillac, far left, by pair of concentric tubes. Vacuum control is used on both Studebaker, left, and Nash, above

Fig. 2—Hollow tube and flexible cable are used for remote control of Pontiac transmission, below



lished by a lever projecting to the right under the steering wheel which is raised or lowered in a direction parallel with the column corresponding to the neutral transverse travel of the ordinary gear shift. A pair of concentric tubes ahead of the steering column shown in *Fig.* 3, each actuate on oscillating shaft in the transmission case by a connecting rod, one controlling reverse and low, the other, second and high. Pontiac's version is slightly different. The shifting lever *A* in *Fig.* 2 actuates a single tube *B*, being pivoted in the bracket *C* which is welded on tube *B*. Raising or lowering the ball end of lever *A* causes an axial movement of the control rod *D* which is engaged by the lever through a ball and socket connection as shown in the small detail. This motion is conveyed through a flexible cable *E* to a selector plate within the transmission. A single lever *F* actuates shaft *H* in the transmission cover, motion being conveyed to it by rod *G* which is connected to the ball joint on the lever *J* welded to tube *B*. Movement of lever *A* rocks the transmission lever *F* and the control rod *D* enables the selector plate within the transmission to transfer the oscillating movement of shaft *H* to either shift rail within the transmission.

The Evans vacuum gear shift is available on Graham, Nash and Studebaker. A miniature shifting lever is located near the center lower portion of the instrument panel as shown in *Fig.* 4, this depicting the Studebaker. *Fig.* 5 diagrammatically shows the layout with a diaphragm at the side of the transmission operating the pick-up of either of the two shift rails.

The outstanding transmission development is the automatic self-shifting unit offered on the Oldsmobile and the Buick 40. *Fig.* 7 is a bottom view of the Oldsmobile unit. A single reduction planetary system is placed ahead of a double reduction set so that either of four gear ratios is available. A sliding direct and reverse gearset is located at the front of the unit. The planetary brake band of each of the sets is tightened by a nest of coil springs under compression. To free the drums, these springs are pressed by an hydraulically-operated piston which is under the influence of a centrifugal governor (sensitive to engine speed) and throttle control valve. The hydraulic piston also actuates the multiple disk clutch of the planetary set. A third control is through a selector lever under the steering wheel as shown in *Fig.* 6, having four positions: Reverse, neutral, low and high range. The low range controls first and second gears and the shift from one to the other is made automatically at about 6 miles per hour. The clutch is

used only in starting. When the selector lever is shifted to the high range the transition to third automatically occurs at any speed above 6 miles per hour and at 23 miles per hour or higher, fourth speed or direct drive is engaged. The standard Oldsmobile is geared 4.375-1 in the rear axle but with the automatic transmission this ratio is made 3.55-1. The forward transmission ratios are 3.16, 2.23, 1.42 and 1-1. It will be seen that the fourth speed corresponds to the overdrive of other cars when taking into consideration the overall engine-to-wheel reduction ratio.

All of these remote transmission controls aid in holding down the noise level in the body interior by eliminating the conventional gear shift lever which telegraphs vibration directly from the source.

The most interesting engine development is the 16-cylinder Cadillac, a V-type engine with an angle of 135 degrees between the banks. This spacing results in a practically continuous flow of power since an explosion occurs every 45 degrees of crankshaft rotation. The bore and stroke are both 3¼ inches, giving a displacement of 431 cubic inches. The combustion chambers are machined all over to avoid any possible compression variation. Compression ratio is 7-1, the engine being designed to run on ethyl fuel. *Fig.* 8 shows the engine with its dual V-belt quadrangular drive. An individual water pump is located on each side with the fan pulley centrally above. Generator is driven at 1.95 engine speed. The set-up is obtained by means of a friction drive shown in *Fig.* 9 in which the conical drum within the belt pulley has a rubber driving ring vulcanized to it against which the generator driving wheel is pressed. The fan-pulley combination is supported by a bracket on the engine by two studs, one of which, as will be noted, provides a pivotal point; the other is located in a slot whereby the belt tension can be adjusted. Front cover of the generator is secured in like manner to the fan mounting bracket to adjust the frictional contact between the generator driving wheel and the rubber ring.

Vibration and noise occur when there is a periodic bending of the crankshaft. This takes place at critical speeds just as torsional vibration in a crankshaft manifests itself at its critical speeds. Any bending of the crankshaft causes a wobbling action of the flywheel and to minimize this condition, all Cadillac V-8 engines are equipped with a "syncro-flex" flywheel. The cast-iron flywheel rim is free of the conventional rigid web that normally attaches it to the crankshaft flange. In its place is a flexible disk which is rigid torsionally. There are damping plates at each side of the web and near the outer periphery six bronze washers are located at each side between the plate and the web. These are centered by pins passing through holes in the damping plates and a large clearance hole in the web. A spring on each pin maintains frictional con-

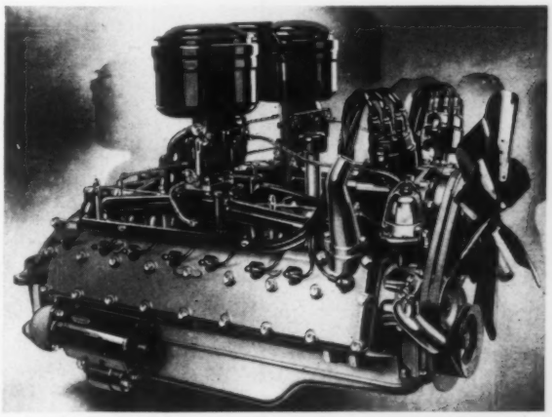
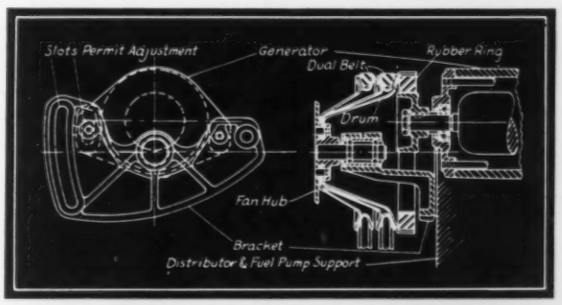
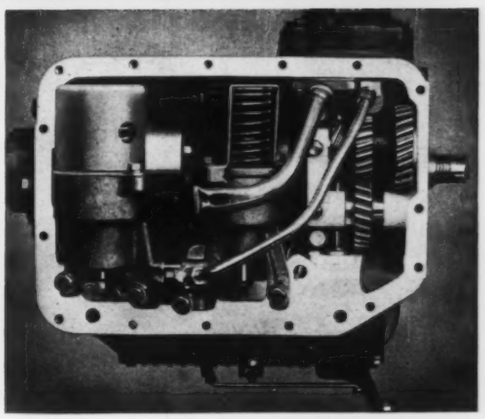


Fig. 8—Cylinder banks of Cadillac 16-engine are 135 degrees apart, giving a power impulse every 45 degrees of crankshaft rotation

Fig. 9—Rubber ring inside of fan pulley bears against generator wheel, turning it 1.95 times engine speed





Figs. 6 and 7—Lever at the steering wheel on Oldsmobile controls reverse, neutral, low and high range of transmission. Gears are automatically shifted by hydraulic cylinders in gear box, right, for other speeds

tact. It will be seen that this construction permits the flywheel rim practically to maintain its normal rotational position and that when bending does occur, any deviation from the true motion results in a dampening action.

All of the present individual wheel suspensions for the front wheels utilize coil springs. Buick is the first one to utilize this type at the rear and thus has been able to eliminate the troublesome interleaf friction of the leafspring, discard shackles and small parts and reduce the unsprung weight. The construction used is shown in *Fig.* 10. It will be been that the coil spring rests on a bracket extending rearwardly under the axle housing. The regular Buick torque tube retains the axle in a fore and aft position. To prevent relative side movement between the frame and the axle, a transverse stabilizer link is attached to a bracket welded to the axle housing at the right end and to a bracket bolted to the frame at the left. The hollow rectangular link is rubber bushed at each end. An important item in this suspension system is the direct-acting shock absorbers at each side attached to a forward extension of the axle spring bracket and a bracket on the top of the frame rail. A special shock absorber was developed with a 1⅜ inch piston (1 inch customarily used), because of the greater amount of work that must be performed with a frictionless spring.

The 6 and 8-cylinder Packards use leaf springs but they have cupped depressions on the end of the leaves as shown in *Fig.* 11. Where the interleaf movement is greatest, oil impregnated bronze inserts are used. In other places buttons of rubber permit relative movement. In each instance the leaves are separated and the customary interleaf friction obviated. There is no frictional rubbing where the rubber buttons are used as the rubber merely flows.

A brand new idea in clutch design has been introduced by Chevrolet in which a diaphragm spring replaces the former pressure springs of the coil type and the release levers together with their mounting. The diaphragm spring has the shape of a dished washer with 18 integral, inwardly-pointing, tapering fingers. When the clutch is engaged, the rim and fingers are flat as shown in *Fig.* 12 and the entire rim bears against the pressure plate, giving uniform load distribution. Two wire rings which are centralized by nine studs act as fulcrums when the washer dishes or flattens out. Pressure of the throwout bearing on the integral fingers causes the diaphragm action which effects release. A further virtue of the new construction is the decreasing pressure after the initial down stroke of the clutch pedal which, in the ordinary construction, increases with travel.

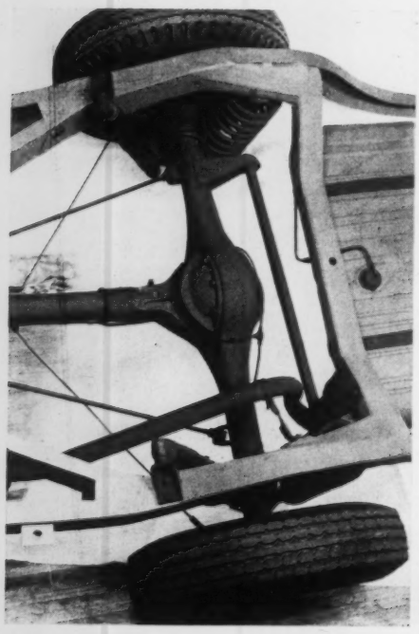
Clutch Linings Improved

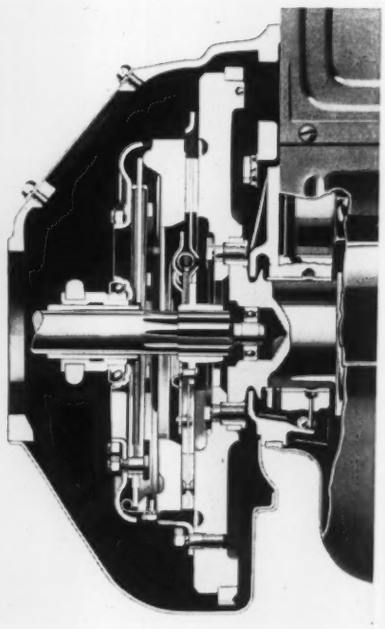
Clutch linings have been improved in the direction of centrifugal bursting strength. This is due to the increased engine speeds and to the fact that more shifting is now done at high speed.

A wide sparkplug gap has been found beneficial for operation at high speed when the mixture around the points is liable to be contaminated with burned gas from the previous explosion or should stratification of the mixture occur. Heavier duty coils are required and it is interesting to note that Hudson and Terraplane are now using spark plugs that are set to a .032-inch

(*Continued on Page* 90)

Figs. 10, 11 and 12—Large diameter shock absorbers are prominent parts of the Buick rear coil spring suspension, below. Packard, middle view, features leaf springs with cupped ends to reduce friction. Cross section of new Chevrolet clutch is shown at right





Scanning THE FIELD FOR Ideas

LOCK gates at the mouth of Chicago river are being equipped for automatic two-speed electrical operation by units which combine gearmotor and heliocentric reduction. These units, one for each of the four leaves of the gates, were built by Universal Gear Corp. for Frazier-Davis Construction Co.

Slow speed drive is from a 1½-horsepower gearmotor, mounted on the side of the unit, to main output shaft through three reductions totaling 30,000 to 1. The final reduction worm gear is integral with heliocentric rack and carries plungers and holders with it as it revolves. A 25-horsepower motor, vertically mounted at the top of the unit, is locked by a magnetic brake while the small motor is operating.

When this large high-speed drive motor cuts in, the brake releases. With the small motor now inoperative, the heliocentric rack is held stationary by self-locking action of the worm gear and the unit operates as a heliocentric reducer, driving vertically on a straight line with total reduction of 350 to 1.

The heliocentric mechanism has three main elements: An input shaft carrying an eccentric; a battery of reciprocating plungers operated by the eccentric, and carried in a slotted holder integral with output shaft; and a rack resembling an internal gear. The plungers slide into this rack causing the output shaft to rotate through the arc of one rack tooth for each plunger cycle or revolution of the input shaft.

Four-in-One Hydraulic Turbine

WHILE reviewing present tendencies in water turbine machinery in a paper written for the Institution of Mechanical Engineers (Great Britain), A. A. Fulton suggests some interesting design possibilities in connection with Pelton-type wheels such as are used in high head installations.

These wheels are driven by a relatively thin stream of water projected from a needle valve nozzle. The rim of the wheel, or runner as it is called, carries double spoon-shaped buckets and the high velocity stream splits on the sharp edges between the two halves of the buckets. This split stream—reversed by the curved buckets—gives the wheel (when running free) a peripheral speed of approximately half that of the impinging stream of water. Pelton wheels ordinarily are direct connected to electric generators.

It is common practice to design other types of water turbines, the Francis type for instance, with vertical impeller shafts. Pelton wheels, however—like single stage high pressure steam turbines which they resemble—almost invariably are mounted on horizontal shafts. Mr. Fulton questions this design tradition when he says that not only is it difficult for him to understand the popularity of the vertical arrangement on all but extremely high head Francis turbines, but also that it is equally difficult for him to understand why Pelton turbines with vertical shafts are so seldom used.

He goes on to point out that while it is very rare nowadays for vertical shaft Francis turbines to have

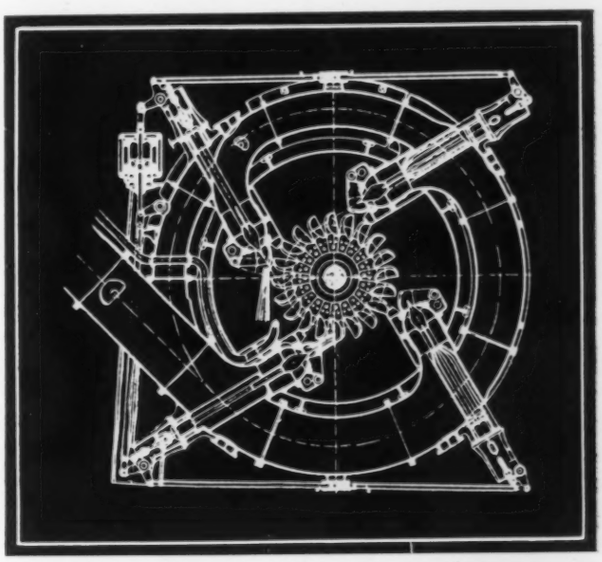


Fig. 1—Top view of vertical Pelton hydraulic turbine having four nozzles acting as its single wheel

more than one runner, it is a simple matter to obtain the same effect in the case of vertical shaft Pelton turbines. With the latter there is no question of duplicating the number of runners because the end can be accomplished equally well by the simple expedient of multiplying the number of jets. Such an arrangement as illustrated in the Fulton paper is reproduced herewith as *Fig.* 1, which is a section through a vertically mounted, multiple jet Pelton turbine as viewed from above.

Shift Short-Circuits Magnetism

DEVELOPMENT of new alloys which, when made into permanent magnets, have several times more power than do magnets of older types of steel, has resulted in important developments in many directions. One practical example of this is furnished by the magnetic chuck shown in the lower section of *Fig.* 2.

This chuck, built by the Brown & Sharpe Mfg. Co., firmly holds iron and steel parts to its surface magnetically without requiring electrical power to energize it. Built into its body are a number of high power permanent magnets of one of the new alloys. These magnets are interspaced with high permeability iron conductor bars and nonmagnetic spacers, as shown in the diagrams in the upper section of *Fig.* 2. The top plate also is divided up by nonmagnetic spacers.

By throwing a crank on the side of the chuck the body can be shifted endwise in relation to the stationary top plate and base. When the crank is thrown over to the right—that is, in a clockwise direction—the power is "on" and work will be held down to the top plate by magnetic attraction. In that position (see left-hand diagram) the divisions of the top plate lie in such relation to the magnets that the path of the flux is through the top plate and into the work, thus

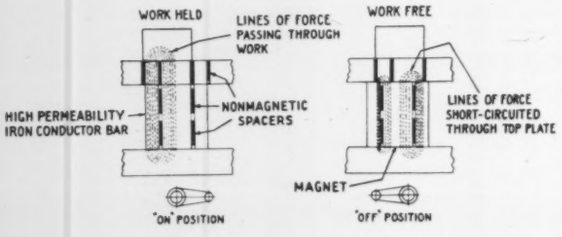
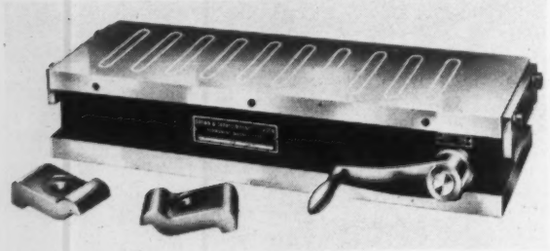


Fig. 2—Permanent magnet chuck releases when flux is short-circuited by shifting the chuck body



holding it. In other words, the work is in a position like that of the soft iron "keeper" held down across the poles of the familiar horseshoe magnet.

When the crank is thrown over to the left (counterclockwise) the magnets change their relation with the divisions of the top plate in such a way that the lines of force—instead of reaching into the work as before—are "short circuited" in the top plate itself.

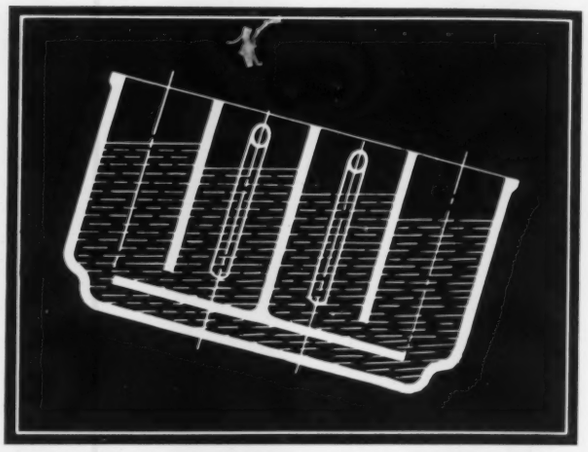


Fig. 3—Aero-type carburetor for automobiles has baffles to equalize fuel level at dual jets

Airplane Influences Automobile

SOURCES from which design influences originate are apt to change greatly from time to time. An example of this is given by the automobile and the airplane. In the early days of aircraft development, the design of aircraft engines was largely influenced by the design of automobile engines. Today, with aircraft engines highly developed along their own individualistic lines, their design in turn is having considerable influence on the design of automobile engines.

For instance, consider the subject of carburetors. In order to counteract the effect of turns at high speed, it became necessary for aircraft engineers to introduce certain modifications in carburetor design. Eventually, when the normal speed of automobiles was greatly increased, similar difficulties began to be encountered with their carburetors. The result was that carburetors of aero-type have been adopted by automobile manufacturers.

One of the design features of these carburetors is illustrated by *Fig.* 3, which shows the fuel chamber of a Stromberg aero-type carburetor having two side-by-side jets. With an ordinary single-well chamber, level of fuel in relation to the two jets is constantly affected by leaning of the car on the side of a crowned road, by oscillation of the engine in its flexible mountings, or by leaning of the car on sharp turns. The fuel also tends to surge toward

the outside of a turn. All these things are bad for engine performance.

To overcome these troubles a system of baffles used in Stromberg carburetors for aircraft has been introduced into the automobile carburetor. The effect of these baffles and the system of connecting the wells formed by them is shown clearly in *Fig.* 3. Note that while the chamber is tilted, the level of the fuel in relation to the two jets remains undisturbed.

Steam Jet Maintains Vacuum

DEVELOPED originally for creating vacuum in steam condensers in power plants, the steam jet ejector is now finding a wide variety of industrial uses. Ability to maintain extensive piping and tank combinations under high vacuum give it wide possibilities with process machinery.

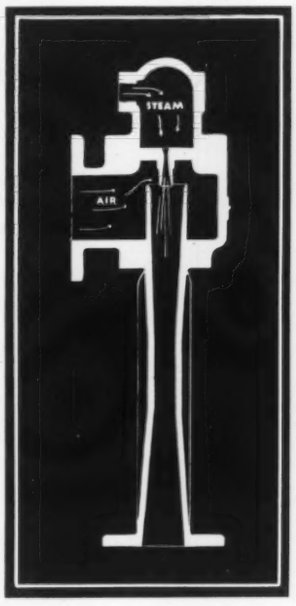


Fig. 4—Suction pump of steam jet ejector type with no moving parts has ability to exhaust air, other gases and vapors rapidly and to maintain high vacuum, thus being an extremely useful detail in many process machinery assemblies

While it definitely is a type of vacuum pump or compressor capable of handling air, other gases and vapors at exceedingly high speeds, the device itself has no moving parts. It operates entirely on what is called the "kinetic principle." By expanding steam from higher to lower pressure through divergent nozzles, pressure energy is converted into velocity energy of several thousand feet per second. Discharge of steam from the nozzles is by directed flow into a diffuser.

Prior to entering the diffuser, however, the steam mingles with and entrains the gas or vapor to be evacuated—imparting to it a portion of its own velocity. Then the mixture passes through into the "convergent-divergent diffuser" where most of its velocity energy is converted into static pressure, thus overcoming the vacuum created at the diffuser outlet.

The principle is clearly illustrated by the diagram *Fig.* 4, which is a section of one of the steam jet ejectors developed by the Elliott Co.

Oil Flow Determines Air Feed

EFFICIENCY of combustion in open hearth glass melting, boiler and other oil burning industrial furnaces, is maintained automatically by an interesting mechanical device developed by the Askania Regulator Co.

This mechanism, which is called an oil transometer, is depicted in *Fig.* 5 with protecting covers removed to reveal its internal workings. Its sprocket is chain driven from a positive displacement meter on the oil line. As the speed of this sprocket increases or decreases on account of variations in oil flow through the meter, the weights on the revolving flyball governor move outward or inward through corresponding variations in centrifugal force —their speed being in proportion to flow of oil.

By means of elbows which can be seen clearly in the illustration, movement of the governor flyballs is transmitted vertically through a push rod connected to a pivoted jet pipe mounted under the cap of the regulator. Air introduced into the right-hand inlet is blown from the pivoted jet pipe into a receiving nozzle at the left which is connected to the top of a diaphragm in the cap of the unit.

Since the air pressure on the diaphragm depends upon the position of the jet pipe, the more nearly this jet pipe registers with the receiving nozzle, the greater is the air pressure on the diaphragm. In operation the position of the jet pipe is always such that the air pressure on the diaphragm balances the centrifugal force of the governor. Thus the air pressure created through the action of the governor is in direct proportion to the centrifugal force of the governor—therefore a square function of the oil flow through the meter. Connection between

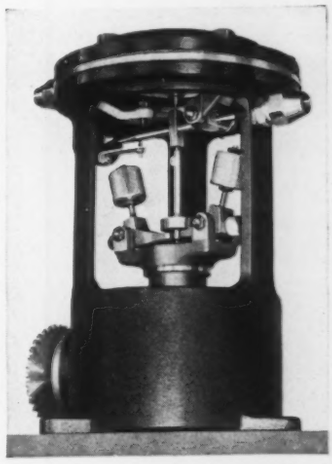
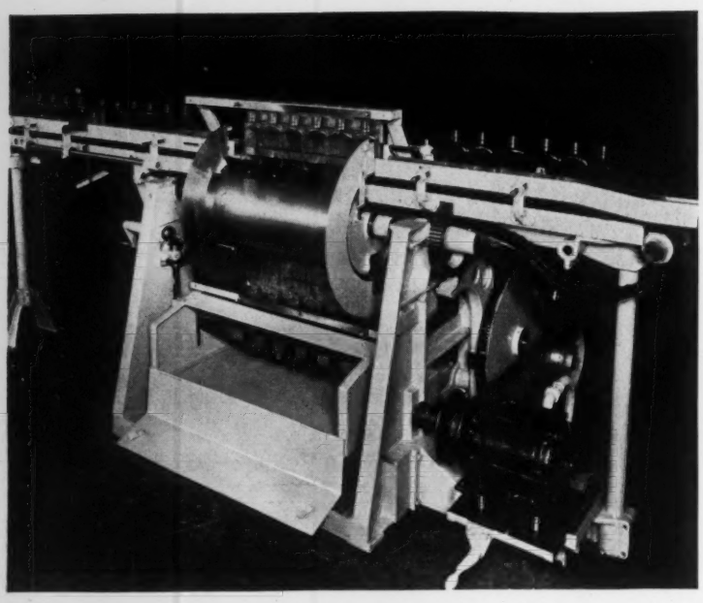
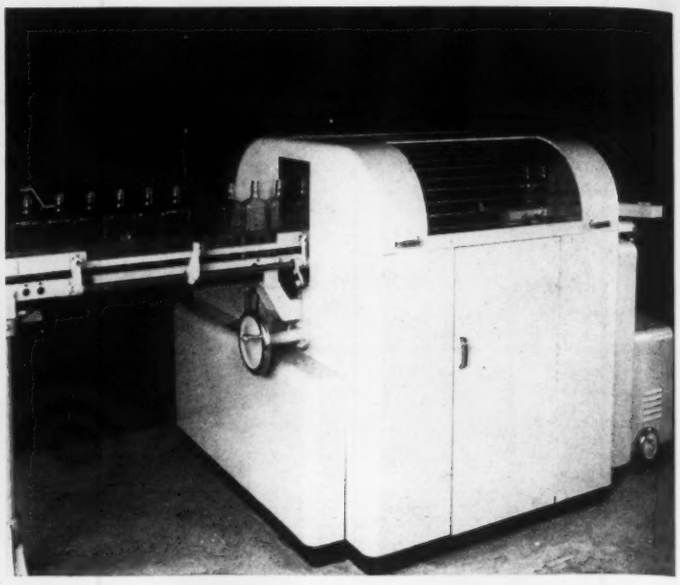


Fig. 5—Automatic proportioning of air to fuel, to maintain combustion efficiency in industrial furnaces, is accomplished by flyball governor mechanism operated by the oil flow meter



Comparison between original bottle washing machine, above, and restyled model at right shows how unguarded mechanism is enclosed for safety and appearance



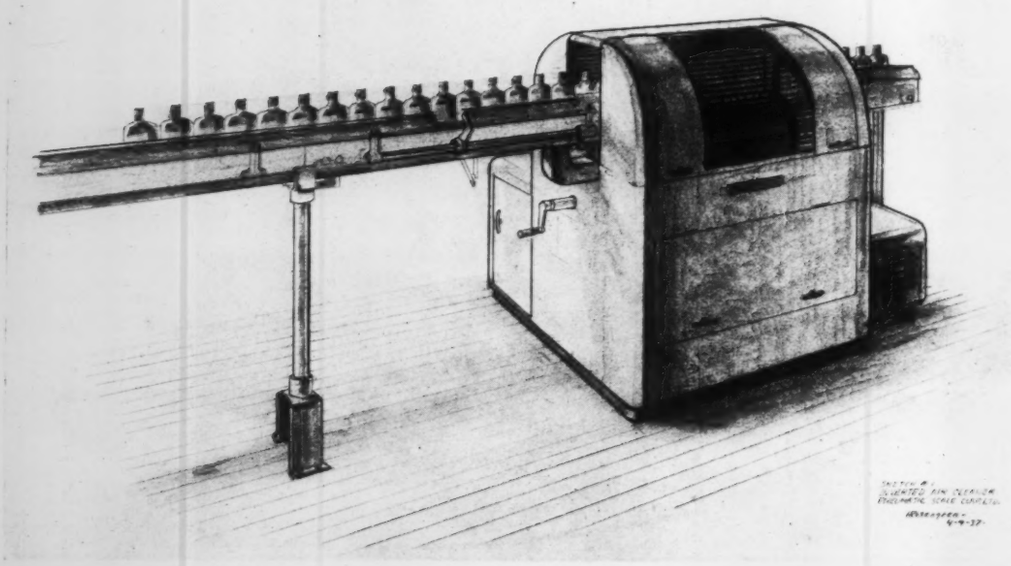
All sharp projections are eliminated and handwheels have artistic touch. William H. Newey and Stanley Howard of Pneumatic Scale Corp. worked with the author

New Designs for Old

MOTOR cars once were sold almost entirely on their mechanical qualities. Buyers bought on the theory, which is a sound one, that the machine which functions best is the best buy. But increased competition has changed selling habits in the automobile industry just as it is changing the designing and selling habits of other machine manufacturers. With the perfecting of mechanical details, other factors have entered the sales picture. Comparatively few mechanical changes are evident in the new models, but from an appearance standpoint, 1938 cars bear little resemblance to their predecessors of a year or two ago.

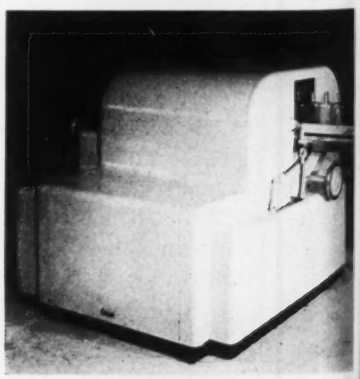
Alert manufacturers of machinery such as machine tools and other mechanical equipment also realize that to sell their machines, they must be "dressed up." This does not mean the addition of countless gadgets and the indiscriminate use of plated surfaces, but a general redesigning to eliminate awkward projections and incorporate a durable and attractive—not flashy—finish. Appearance is certainly a prime consideration, and though it may not always seem sensible, even machines used for pure-

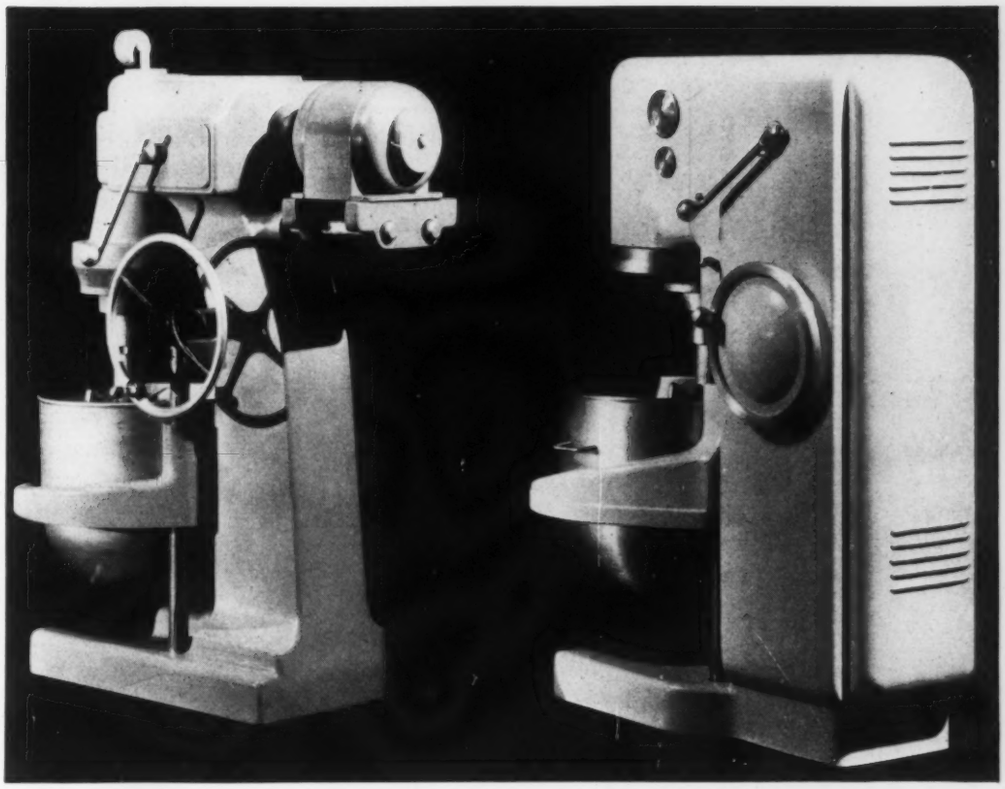
(*Concluded on Page* 40)



Close similarity exists between the artist's sketch left, of proposed machine and the finished model

Rear view of new model, below, gives idea of sweeping lines and smooth, sanitary finish

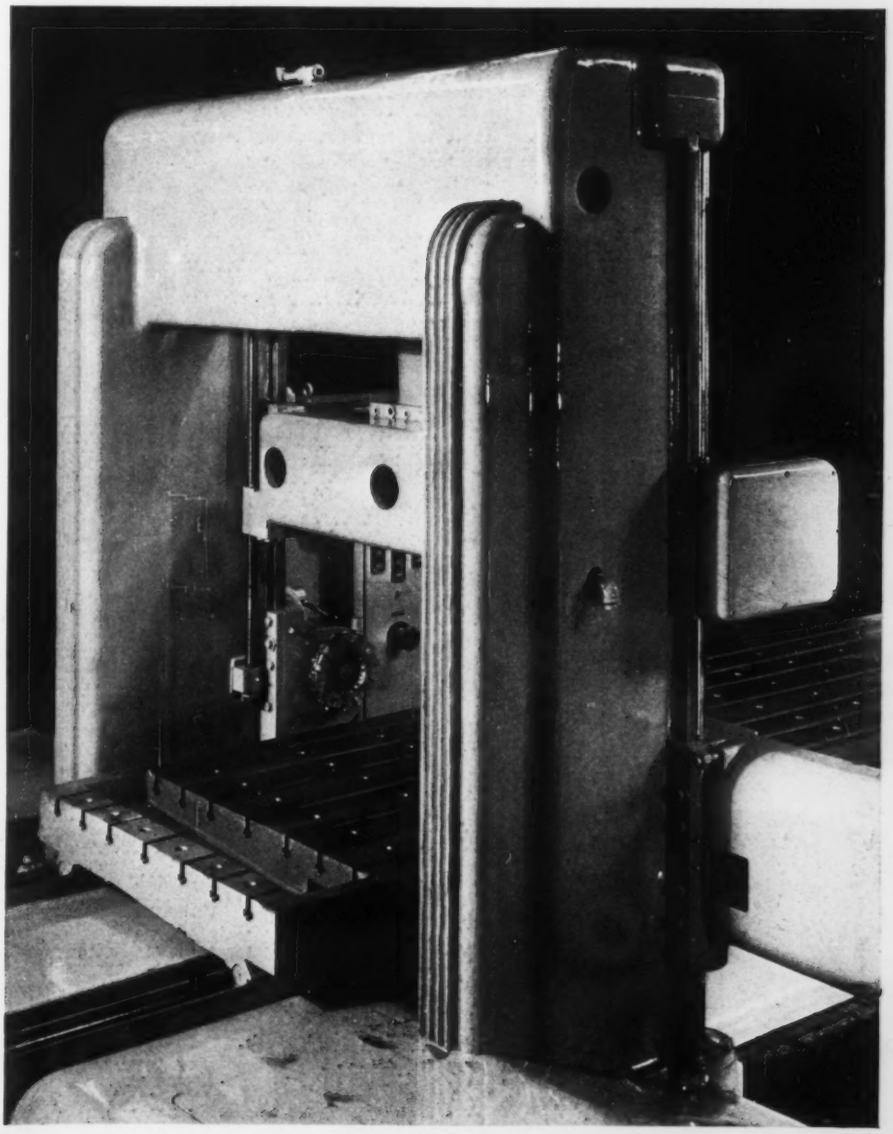




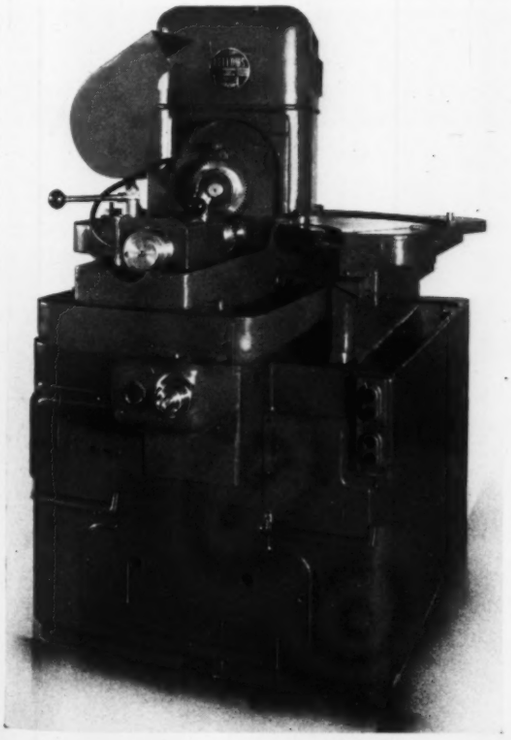
Before-and-after views of the American Machine and Foundry Co. food mixer depict the contrast between the old and new models. New machine, having simple, unbroken surfaces is easily cleaned, an important point in bakery equipment design. Collaborating with the author in this design was Walter Dehuff of the machinery company

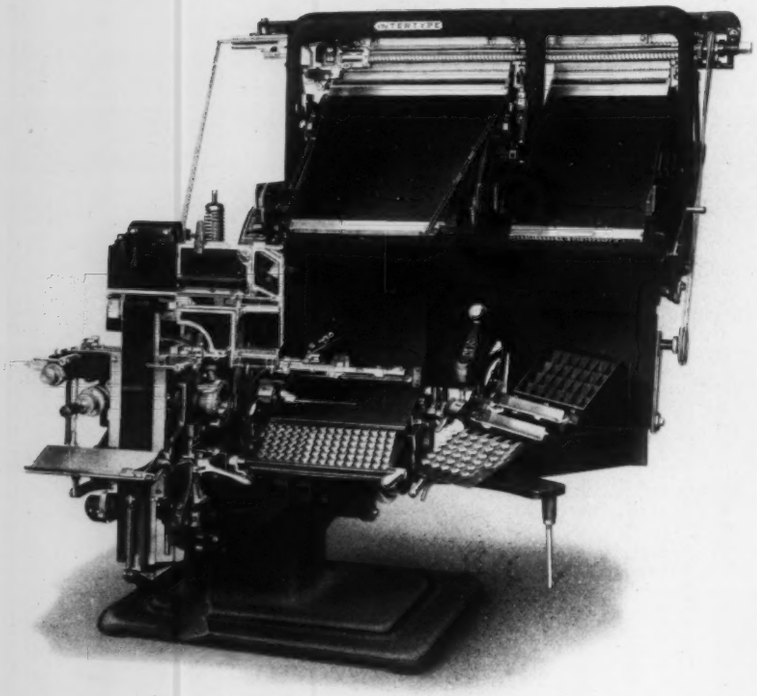
By
Herbert Rosengren

Rear view, below, of rail milling machine shows styling is consistent with the heavy work the machine performs. J. R. Johnson, chief engineer of Ingersoll Milling Machine Co., collaborated with Mr. Rosengren



E. W. Miller, chief engineer of the Fellows Gear Shaper Co., was assisted by the author in the redesign of this enveloping gear generator. Built-in controls are a feature, as well as the absence of projecting parts





Typesetting machine is example of intricate mechanism styled for operating simplicity and convenience. New base gives more foot room; parts formerly nickel plated are finished in satin hue to reduce glare. Machine was redesigned by author in collaboration with H. R. Freund of the Intertype Corp.

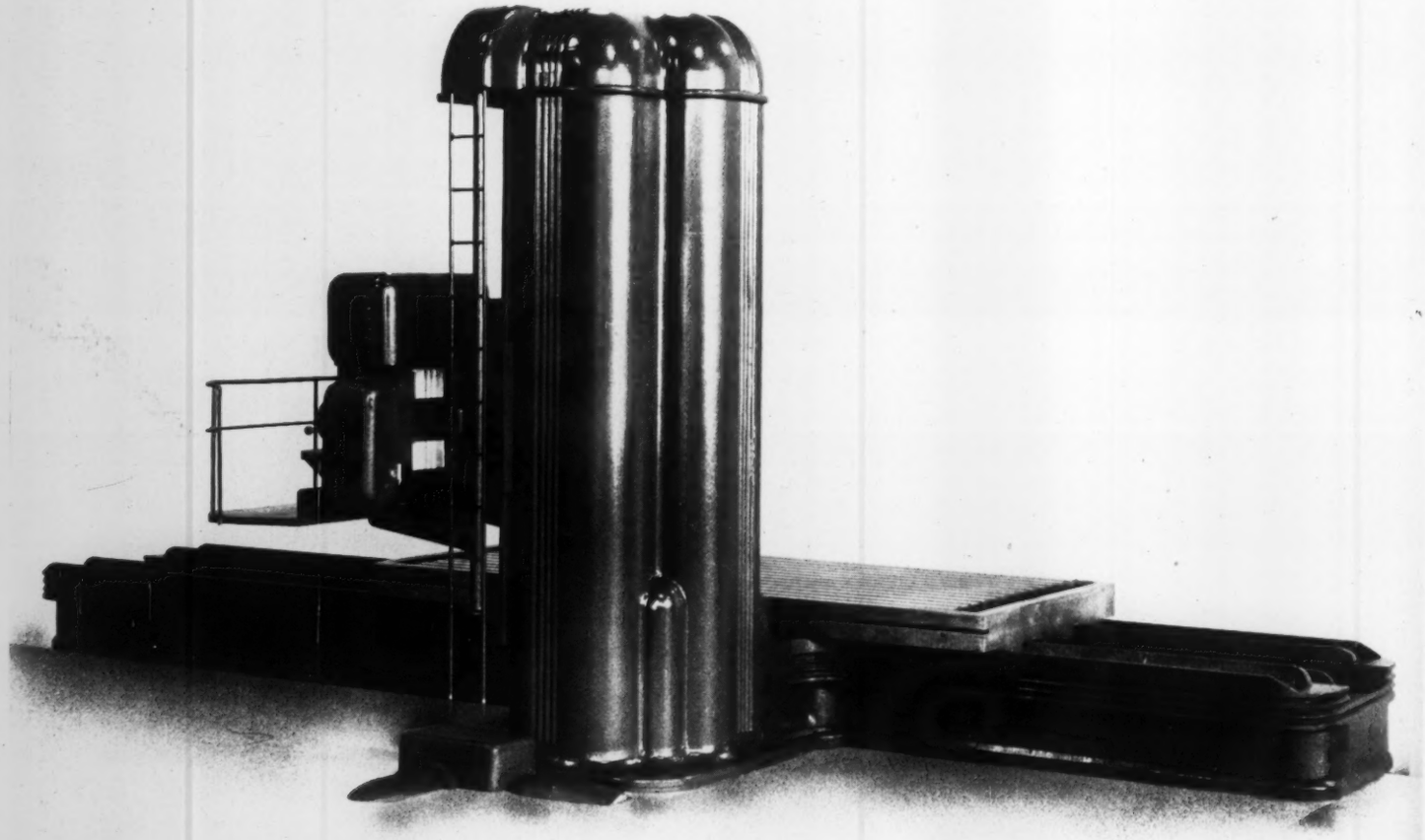
(*Concluded from Page* 38)

ly utilitarian purposes are in favor if they incorporate the trend toward modern styling.

A future which calls for unrelenting change is not a happy thought for the machine builder, yet the sales analyst knows that a shrewd commercial buyer is swayed almost as much as the fickle public by a beautifully styled machine. The buyer will choose the one that has the look of inherent quality; is so designed as to be easily serviced and cleaned. The day of machines often dubbed "mankillers" is past and a manufacturer might as well give up if his machines continue to be handicapped with inaccessible controls, cranky levers and a bewildering accumulation of brackets and gadgets.

Modern industry has created the specialist in all lines of endeavor, but because the industrial designer or stylist is a comparatively new figure in the design department, many engineers look upon him with suspicion. In styling machines, however, the industrial designer is trained to work whole-heartedly with the chief engineer and designer to produce a machine with sales appeal as well as mechanical efficiency. He stakes his claim to be numbered with the engineering department talent in the belief that his contribution fills a definite need.

Wooden scale models of new Ingersoll milling machine were built first on which forms were worked out. Such parts as ladder and guard rail were designed to emphasize elements to which they are applied



Reissue Patents Correct Early Defects

By George V. Woodling

THE supreme court has said, "the specification and claims of a patent, particularly if the invention be at all complicated, constitute one of the most difficult legal instruments to draw with accuracy." Because of this difficulty many patents are defectively prepared and prosecuted. It is not surprising to find that a patent may fail to describe the exact invention of the patentee by omitting some provision which was a valuable part of the actual invention, or to claim that which the patentee had not in fact invented.

When a defect in a patent is found the law provides that under certain rigid rules and conditions the mistake may in some instances be corrected by re-prosecuting the patent all over again. The patent which matures from this re-prosecution is called a reissue patent. It must not be inferred that a reissue patent extends the life of the patent beyond the original seventeen year period. The reissue of a patent only corrects the defect for the remaining unexpired part of the term of the original patent.

Many epoch making patents have been reissued. Of these great inventions, the patent issued to Samuel F. B. Morse for the telegraph is an example. See *Fig.* 1. This patent was reissued on June 13, 1848, and bears reissue number 117. Up to the present time there have been more than 20,000 patents reissued. Four hundred and twenty-two were reissued in 1936. Besides the patents which are actually issued there are many which are defective and have not been reissued because the error has not been discovered. This happens particularly in those patents where the invention possesses little merit and fails to attract the attention of industry.

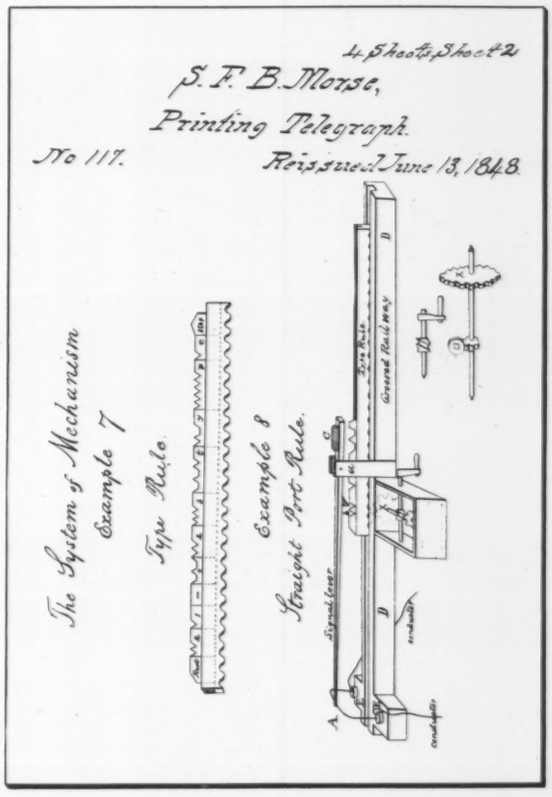


Fig. 1—Patent issued to Samuel Morse for the telegraph was one of the first important ones to be reissued

Besides the statute regulating the conditions under which reissue patents may be obtained, the courts have injected additional requirements to be satisfied before a valid reissue patent may be granted. These added conditions require the patentee to exercise reasonable diligence (1) in discovering the defect and (2) in filing the reissue application. In order to give a complete perspective of the requirements of the statute and of those imposed by the courts for a reissue application, the following outline is developed. All of the provisions in the outline are found in the statute, except items D and E, relating to reasonable diligence, which are required by the courts.

I ORIGINAL PATENT MUST BE WHOLLY OR PARTLY IN-

AS announced in an earlier issue of this journal, the book on patents:

"INVENTIONS AND THEIR PROTECTION"

by George V. Woodling, will be ready for distribution in January. Mr. Woodling is well known to readers of MACHINE DESIGN as the writer of many valuable contributions covering inventions and patent law. Summary of contents and complete information on his book appear on page 93

OPERATIVE OR INVALID BY REASON OF:

A. Defective or insufficient specification which includes:
   a. drawing
   b. description, and
   c. claims

B. The patentee claiming as his invention or discovery more than he has a right to claim as new.

II THE ERROR RENDERING THE ORIGINAL PATENT INOPERATIVE OR INVALID MUST HAVE ARISEN BY:

A. Inadvertence, accident or mistake, and

B. Without fraudulent or deceptive intention.

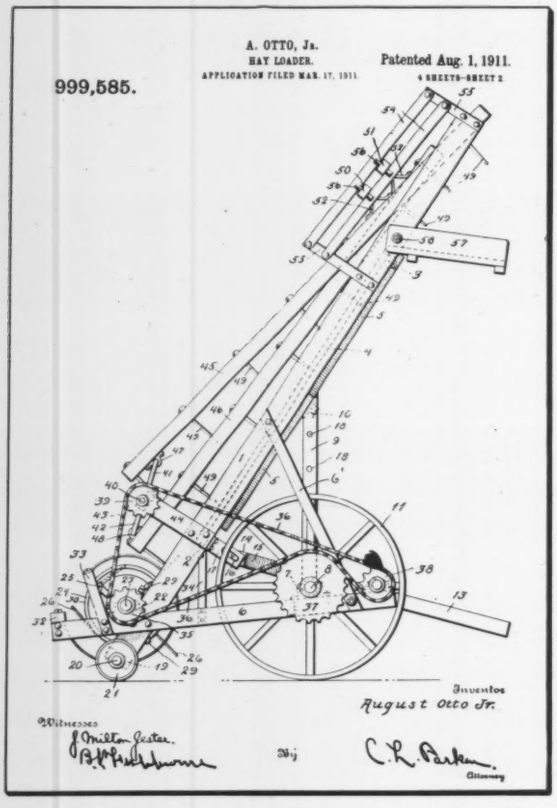


Fig. 2—Reissue patent could not be obtained on this hay loader because patentee waited too long before filing application

III CONDITIONS WHICH MUST BE COMPLIED WITH:

A. The invention sought to be covered by the reissue patent must be the same invention as that in the original patent.

B. The correction of the defect in the original patent must not add new matter.

C. The patentee must surrender the original patent.

D. The patentee must have exercised reasonable diligence in discovering the defect or error.

E. The patentee must have filed the reissue application without undue delay.
   a. The patentee must act with reasonable promptness in filing the reissue application after the defect is discovered.
   b. When broadening the scope of the protection, the reissue application must be made within two years from the date of the grant of the original patent.

Defects must appear in the specification which includes the drawing, description, or claims of the patent, and not elsewhere. Accordingly, a reissue patent cannot be obtained to take the place of an original patent which is invalid because it was prosecuted in the name of the wrong inventors. The statute makes no provision for correcting the error in the names of patentees.

The defective or insufficient specification must not have resulted from an error in judgment, as distinguished from a bona fide mistake inadvertently committed. Let us suppose that an inventor, through his attorney, without intending to do so, drafts or accepts claims not commensurate with his invention. Here a question arises: Was the accepting of inadequate protection an error in judgment which cannot be corrected by a broadening reissue? If the reissue is not an attempt to incorporate after acquired knowledge but is simply an effort to express in technically correct phraseology what had been botched in the original patent, then it may be corrected. On the other hand, a reissue patent cannot be permitted to enlarge the protection of the original patent by including matter once intentionally omitted by restricting the claims to obtain the allowance of the patent.

In a reissue application the drawings, description, and claims may be amended so as to make the subject matter more clear and distinct and to make it conform more to the exact rights of the inventor, but the *invention must be the same.*

By construction, the courts require that the patentee exercise reasonable diligence in applying for a reissue. Thus, a reissue could not be obtained upon the patent for the hay loader in *Fig.* 2, because the patentee waited too long before he filed his reissue application. The patent was granted August 1, 1911, and the reissue application was not made until June 20, 1916. The attitude of the courts regarding delay may be expressed by the following decision which reads in part:

"—It will not do for the patentee to wait until other inventors have produced new forms of improvement, and then with the new light thus acquired, under pretence of inadvertence and mistake, apply for such an enlargement of his claim as to make it embrace these new forms. Such a process of expansion carried on indefinitely, without regard to lapse of time, would operate most unjustly against the public, and is totally unauthorized by the law. In such a case, even he who has rights, and sleeps under them, justly loses them."

In addition to requiring the patentee to exercise diligence in discovering the defect, the courts require the patentee to act with reasonable promptness in filing the reissue application after the defect is discovered. When broadening the scope of the protection, the reissue application must be made within two years from the date of the grant of the original patent, even though the patentee acted promptly in filing the reissue after discovering the defect.

Machine Uses for Tubing

By Guy Hubbard

STEEL tubing, obtainable from stock in a wide range of standard sizes, deserves consideration as one of the important finished or semifinished materials now available to machine designers. That this type of material in its many qualities and forms holds great possibilities for simplifying, improving and at the same time cutting the cost of machine elements is amply attested by recent designs into which it has been ingeniously incorporated.

Steel makers have contributed to this progress through improved alloys and improved methods of forming and finishing tubing. Centerless and other types of cylindrical grinding are now capable of giving accuracy and finish of such high degree that direct use can be made of ground tubing for precision mechanical parts, without secondary surface machining. In other words, the material needs only to be cut to length.

With all respect to the bicycle industry for its pioneering, it is to the builders of woodworking and medium-duty metalworking machinery that credit seems to be due for pointing the way to other than purely structural uses of mechanical tubing in machine design, thereby initiating a definite trend.

Tubing Is Used in Large Machines

Builders of heavy machinery will do well to study carefully some of the clever expedients followed in these lighter machines. Some of them have already done so. There have become apparent lately a number of outstanding instances of adaptations of tubular details to the engineering requirements of large and powerful production machines of successful design. These adaptations include columns of heavy-duty radial drills and the ways of bed-type milling machines designed to handle extra large work.

Ways and means for the successful use of tubing in machine design are in the final analysis up to the individual designer. First and foremost he must have the courage to break with many traditions in design and should see to it that careful computations are backed up by good common sense machine shop practice, and the final results should be checked by drastic running tests. Manufacturers of mechan-

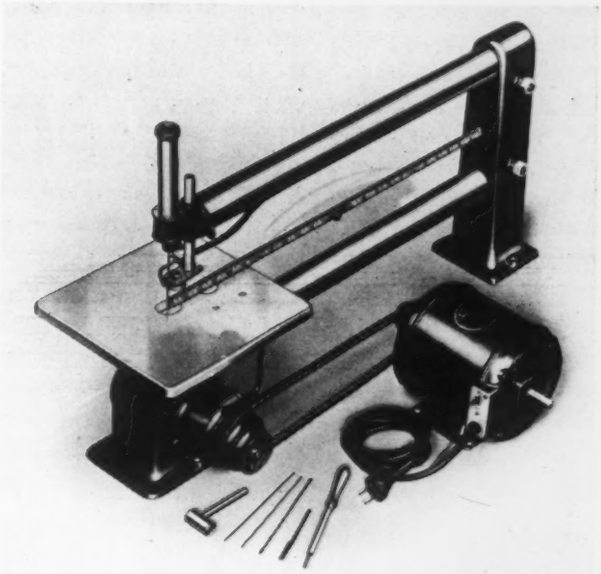
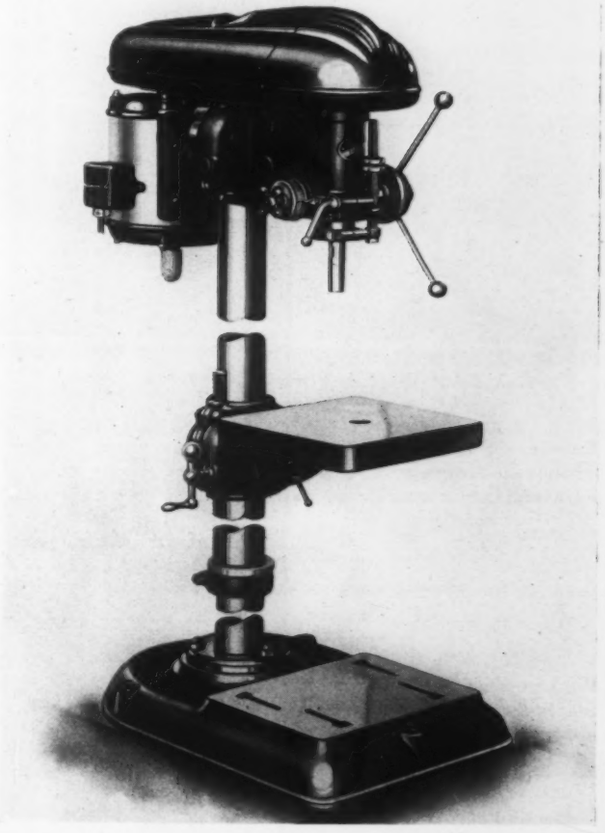


Fig. 1—Tubing provides rigidity with lightness, as arms for this high speed, large capacity jig saw

Fig. 2—Sensitive drill has column of centerless-ground tubing supporting self-contained unit head



ical tubing can be of great help to the designer by recommending the proper kind of tubing to be used. For convenience and economy it should be of stock variety wherever possible, and should be of no more expensive grade and finish than the maximum service requires.

To serve as suggestions toward other and probably very different designs to suit specific cases, several applications of tubing in machines which are built commercially in considerable quantities are used to illustrate this article. Of these illustrations, *Fig.* 1 is of a high speed scroll saw (1750 revolutions per minute), having the unusually large capacity of 24 inches. This machine, which represented the first extensive use of tubing by the Delta Mfg. Co., has frame members of 1⅞ inch centerless ground material with 5/32-inch wall thickness.

Following this successful application, tubing was adopted for the columns of Delta sensitive drill presses, of which *Fig.* 2 is a 17-inch model with capacity up to ¾-inch in cast iron. The column of this machine is a centerless ground tube 3½ inches in diameter and 60 inches long, with 11/64-inch wall. One advantage of this design is that the neatly-styled head, which is a self-contained unit, is readily adaptable to special assemblies, including multiple head machines and as auxiliary units on other machines. In each case sections of tubing provide for simple mounting.

When using tubing in conjunction with castings, which is a common condition in machinery building, careful attention must be given to the method of connecting one to the other. Where parts must be moved for adjustment, bored holes with clamping means are used, as in the case of the drill press table, *Fig.* 2. Where accuracy must be maintained, the clamping system must be designed so that it will not throw things out of line. This calls for close limits in the shop.

Anchoring Tubing in Castings

In cases where tubing is to be permanently anchored into castings, common practice has been to drive or screw it into holes, which in either case requires careful machining. There is another method which is by no means new but with which designers are not generally familiar. This is by the use of expanding metal. This is an alloy of bismuth, lead, tin and antimony, with low melting point, which has the peculiar property of expanding when solidifying—instead of contracting as do ordinary metals and alloys. While this metal is in common use in mounting punch and die parts, its uses in machine building are just becoming recognized.

That the use of expanding metal is by no means a makeshift or temporary expedient is proved by *Fig.* 3, depicting the radial saw manufactured by J. D. Wallace & Co. Arrows in this illustration indicate the eight points in this machine where expanding metal is used accurately and solidly to anchor the finished cylindrical guides into cored holes in the frame castings. While the guides in this instance happen to be rods, the same system obviously would apply to tubing.

The auxiliary view included in *Fig.* 3 shows in

Fig. 3—Above—By the use of "expanding metal", finished tubular parts can be anchored securely and accurately into cored holes in castings

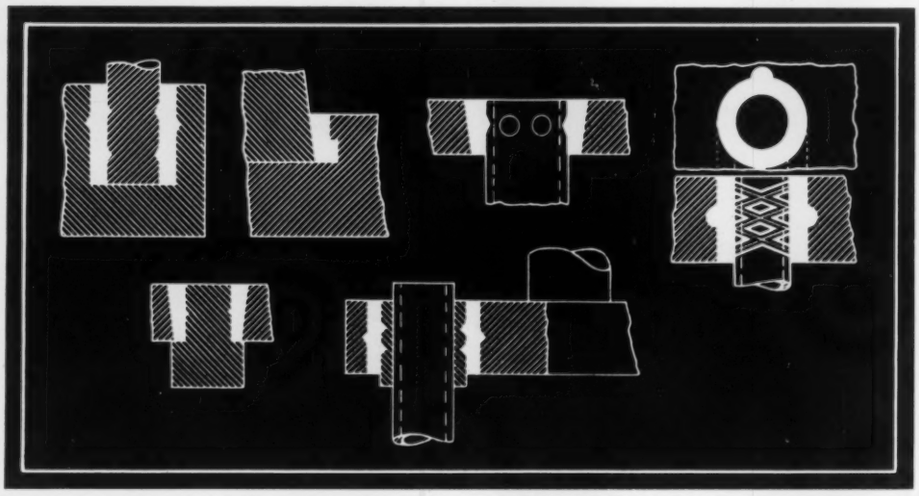


Fig. 4—Right—Diagrams of methods for insuring firm anchorage in connection with use of expanding metal

Illustrations by courtesy of Cerro de Pasco Copper Corp.

section the design of the cored holes in relation to the finished guides and the cast-in expanding metal. In assembling, the castings and the finished members are set up and held accurately in position in relation to each other by means of a fixture. The melted metal is then poured, forming tight mechanical connections in the exact positions required.

Inasmuch as expanding metal in no way sticks to the iron and steel parts as does solder, the designer must always provide for mechanical anchorage. Several simple methods by which firm anchorage can be assured are suggested by the diagrams in *Fig.* 4. While these were drawn up originally for the guidance of designers of punches and dies, the same methods—or slight modifications of them—serve effectively in anchoring tubular details. It should be mentioned in passing that successful applications of expanding metal are being made by several builders of heavy production machine tools.

Once the use of tubing is introduced by a machinery builder it becomes familiar to the designers and spreads throughout an entire line. That—in common with several others—has been the experience of the Walker-Turner Co., whose line includes a wide variety of small and medium size wood and metal-working machinery. In at least five of its machines round seamless steel tubing is used for important parts—columns in particular.

Typical of what this company's designers have accomplished with tubing is the universal belt and disk surfacer shown in *Fig.* 5. The tubular elements in this machine are obvious in the illustration, but the surprising range of adjustments which these elements help to make possible in very simple ways are not so obvious. For instance, the entire machine can be raised, lowered and swiveled about on its main column; the motor can be moved around on its tubular support to tighten the drive belt; and the ground tubular steel column of the abrasive belt assembly not only provides easy adjustment of table under the belt, and of belt tension, but also serves as the dust exhaust pipe from the idler hood to the exhaust nozzle.

Example of Simple Machining

Typical of an application of tubing where—as in some cases already cited—relatively simple secondary machining is necessary, are the rolls used on heavy-duty conveyors built by the Mathews Conveyer Co., of which a sectioned end, *Fig.* 6, shows how the sealed ball bearings are mounted. The body of this roll is seamless steel tubing (.30-.40 carbon), 3½ inches in diameter, with 5/16-inch wall. Whether the rolls are 6 inches long or 48 inches long, tubing is an ideal material for them.

While this article thus far has dealt with tubing in machines of types built in production lots, there is another important field for it—that of the special machine of which only one may be built. The writer saw not long ago in a well known manufacturing plant in Wisconsin, a special purpose machine requiring a very long and horizontal bed with accurate longitudinal ways.

The original conception was something like a long planer bed, which would have weighed several tons and would have cost in proportion to its great weight. What finally developed was a bed made up of finished tubular steel rails with cast end members and intermediate supports. It is light, rigid and distinctly good looking; cost only a fraction of what the solid bed would have cost; and more important than all this, it serves its exacting special purpose better and with less complication than would the ponderous machine originally conceived under the influence of traditional design thinking.

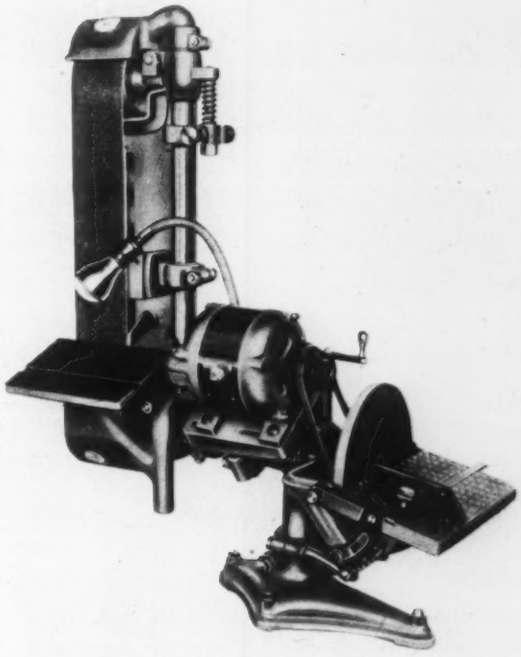


Fig. 5—Tubular support for abrasive belt on machine above serves also as dust exhaust pipe

Fig. 6—Heavy duty conveyor roll, below, is seamless tubing machined only for bearing seats

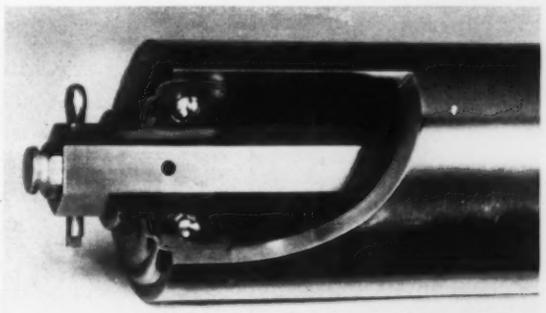


Fig. 1—Plastic radio cabinet produced in single molding has lustrous finish that resists handling and corrosive influences

Plastics in Machines — II

By J. Delmonte

AMONG the foremost considerations in the design of a machine is sales appeal, as determined by appearance. It is in this connection that the experiences and tastes of commercial artists lend a creative interpretation to the design features of a machine. Curved surfaces, recesses, decorative scrolls and other artistic effects may be easily molded with plastic materials, and the article removed from the mold in its finished form. To obtain a similar design in metals, die-cast aluminum or zinc is usually employed. However, the die-cast metal will require an additional finishing operation if it is to be used for decorative purposes.

Advertising and sales literature concerning plastics is replete with illustrations for typewriter housings, scales, meat-choppers, business machines, clocks, handles, radio cabinets (See *Fig.* 1), novelties, electric razors, instrument cases, vacuum cleaners, lighting fixtures, etc. In all of these examples molded plastics substantiate the sales appeal of the articles, by combining in their shapely form a finish resistant to handling, and erosive and corrosive influences.

In selecting an appropriate molded plastic housing the color requirements will often play an important part in choosing the resin. For full, opaque colors phenol formaldehyde molding materials are available in all colors. When a more delicate translucent color is desired, urea-formaldehyde is the choice. A wider

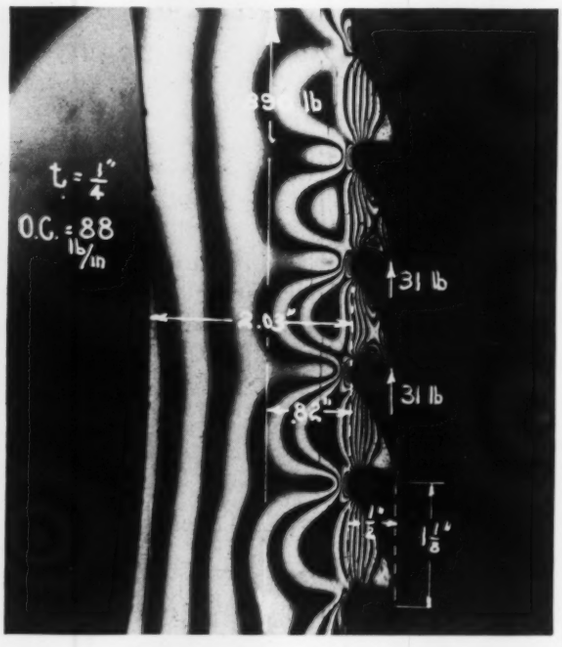


Fig. 2—Photoelastic study of saw stresses are made on a model constructed of a thermoplastic resin

range of colors is obtained with the urea resins. Likewise, cellulose acetate molding powders introduce a number of pleasing, transparent colors. Color, of course, is not always the sole requirement, for mechanical strength, metallic inserts and resistance to abuse may necessitate the use of cellulose acetate or phenol-formaldehyde molding powders. The latter will be less costly and possess greater heat resistance. The more colorful, though more brittle urea resins, lend a colorful appeal to radio cabinets, instruments and automobile dial faces, large luminaires for indirect lighting and similar equipment. Plastics for instrument dials are selected to give the right degree of translucency, and provide adequate legibility of figures when lighted from the rear. Appearance, though of primary concern, is sometimes sacrificed to achieve other properties as heat resistance and high impact strength.

Molding Simplifies Manufacture

EASE OF MANUFACTURE—As a number of operations are completed by molding, this method of forming parts has always been an inducement for the use of molded plastics. For example, an instrument case requires blanking, forming, turning, grinding, sanding, phosphating, enameling and baking in successive operations when made from sheet metal. The manufacture narrows down to one molding operation if manufactured from plastics, and the final finish is obtained directly from the molds. Some grinding may be necessary to remove an excess fin. For small machine parts, injection molding has been developed to increase the rate of production. Plastic materials in a heated cylinder are forced under pressure into cold molds, analogous to the diecasting of metals. Cellulose acetate is well suited to injection molding. Parts such as handles, instrument knobs and gearshift knobs have been standardized for a long time as molded plastic parts. A number of plastic manufacturers maintain stock molds of various handles and knobs for those who do not wish to go to the expense of new molds for these parts. The variety of parts now made of plastic materials is evident by a glance at *Fig.* 4.

It is interesting to note that a substitution of plastic for brass cartridge shells has recently been proposed and patented (U. S. Patent—2,083,665). Though this art is far from complete, there are several benefits accruing from the use of plastic materials. These include: Molding of the plastic cartridge housing about the projectile; absence of corrosion between the brass shell and the metal clip members, minimizing jamming and a cartridge of lighter weight. Phenol plastics have been applied to the above design and withstand shocks incident to the exploding powders better than other types of plastic materials.

RESISTANCE TO WATER—The plastics exhibit a varying degree of affinity for water. For laminated plastic bearings, as pointed out before, water absorption works to the advantage of lubrication. The opposite is true insofar as electrical properties are concerned, as dielectric qualities are impaired with increasing water absorption. Glyceryl pythalate and styrene resins are distinguished by negligible water absorption and excellent electrical qualities. Acrylic, phenolic, and urea resins follow, insofar as water resistance is concerned; cellulose derivatives absorb the most water, usually 2-6 per cent, depending upon the plasticizer and the composition. Toilet float parts, water pump impellers, jars and hydrometer floats are typical examples of mechanical parts requiring good water resistance.

RESISTANCE TO ACIDS, ALKALIES, AND CHEMICALS—Plastic materials are outstanding in their general resistance to acids, alkalies, and chemicals, giving

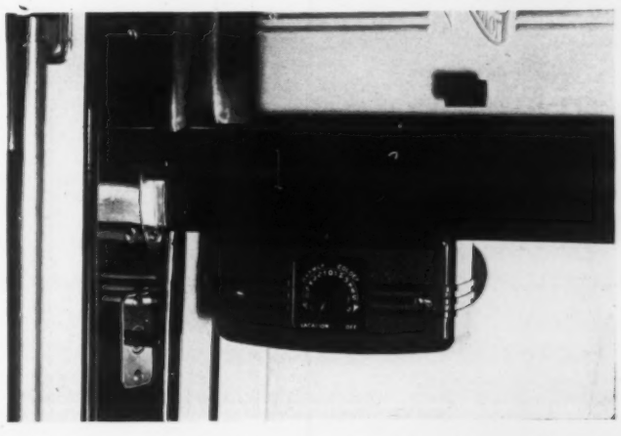


Fig. 3—Food acids do not attack the cold control case, made of a molded plastic, used in this refrigerator

Fig. 4 — Hundreds of standard plastic parts are available and include gears tubing, bearings, etc.

longer service than metal parts formerly used. Because plastics are non-conducting electrically, no electrolytic action is set up as in the case of dissimilar metals when an electrolyte is present. Strong acids and alkalies, however, bring about early deterioration of the substances. Cellulose derivatives are decomposed under concentrated acids and alkalies, and also dissolve by such organic liquids as acetone, ethyl ketone, and methyl acetate. The thermosetting resins, in their heat-hardened state, are impervious to most chemicals, examples of this having been cited previously. Urea formaldehyde is more desirable where the plastic parts are to be in contact with food acids. Unpolymerized phenol resin in the phenol-formaldehyde may give rise to unpleasant odors. Numerous other examples exist in chemical handling apparatus, where corrosion and chemical attack must be kept to a minimum. The cold control case, *Fig.* 3, in the modern iceless refrigerator is of a molded plastic, resistant to food acids.

RESISTANCE TO HEAT—In general, plastics will not withstand very high temperatures. The thermosetting resins, when heated beyond their safe limits, will begin to char and decompose; the thermoplastic resins will soften and collapse. For high heat resistance, asbestos is utilized as a filler with the phenolic resin base. Special molding materials will withstand temperatures as high as 450 degrees Fahr. The cold-molded products find their greatest utility

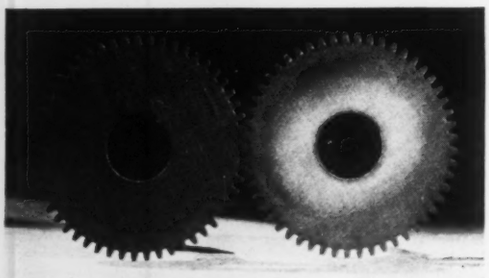


Fig. 5—These laminated plastic gears have made several million revolutions, but wear is negligible

on electrical parts and switches, destined for contact with high temperature heating elements. Where good appearance is more in demand, as in electric iron handles, a high temperature phenolic base may be employed.

FLEXIBILITY—The moduli of elasticity of plastic materials are considerably lower than metals which means that they will deflect considerably more under load. This increased resiliency has certain drawbacks from a structural viewpoint, but it works to advantage in applications utilizing laminated plastic springs, such as Micarta shake springs in a paper mill where the presence of water raised havoc with other materials. Another example is a recent vibration pickup unit. in which the vibrating element is supported by thermoplastic resins. The flexibility of the thermoplastic resins is easily controlled by alterations in the plasticizer content. For printing purposes, rolls of glyceryl phthalate resin have been developed to supplant previous rubber rolls. The new resins obtainable in any degree of flexibility give long service. Cellulose acetate forms a tough resilient product. It is used in sheet form as a substitute for glass, precluding the possibility of shattering the glass and causing serious damage. Much of the noise reduction of laminated plastic gears is attributed to the inherent resilient nature of the plastic.

HIGH IMPACT STRENGTH—For the highest impact strength laminated canvas plastics are used. Among the molded products, the shredded fabric adds increased strength. There is one drawback to these molded plastics. The dark, lustrous surface of the wood flour filled plastic will be missing, and in its place there will appear a wavy surface, slightly mottled in color. Housings for valves, covers for mechanical devices, cams, gears, pinions, bumper shoes on cars, are typical examples of high impact materials. *Fig.* 5 illustrates two laminated plastic gears which have been together for several years without appreciable wear. The laminated plastic applications of high impact products have already been discussed.

Plastics Possess Dielectric Strength

ELECTRICAL—Beyond the scope of this paper but worthy of mention are those plastics emphasizing dielectric strength. Paper base for laminated stock and low water absorption are concomitant with good electrical qualities. Resistance to arcing and corona are important in considering the applications to switches and circuit breakers. Molded ignition distributor heads are almost universal with automobiles.

TRANSPARENCY—The cellulose acetate, acrylic, and clear cast phenol resins fulfill the requirements for transparent plastic materials. They are named in the order of their brittleness, cellulose acetate being the least brittle. In transparent viewing windows for machine parts, these plastics afford a ready substitute for glass. As a matter of fact the acrylic resins, from a transparency viewpoint, are superior to glass, especially at short wave-lengths of light. The transparent resins also fulfill an important function in machine design as an aid to photoelastic analysis. A transparent plastic model under stress, taken under the direction of Mr. Robert Vose, is shown in *Fig.* 2.

In conclusion, the designer must remember that plastics are available to fulfill practically every function in conventional engineering work. A careful study of the available material will indicate those that will give the optimum results.

MACHINE DESIGN wishes to thank General Plastics Inc., Richardson Co., and Mr. R. Vose for the use of photographs which appeared in Parts I and II of "Plastics in Machines."

Design to Fit Operator!

By Warner Seely

The Warner & Swasey Company

Fig. 1—Operating safety and convenience are prime factors in design of an efficient machine tool

MUCH has been said and written recently about the revolutionary developments in machine tool design. Such important basic developments, for instance, as precision antifriction bearings, pressure lubrication systems, semi-steel castings and other improved materials, better gearing, new methods of tool setting, and automatic indexing, which have resulted in spectacular improvements in machine tool performance, have been very widely discussed.

Refinements in machine tool design, the less spectacular improvements that have been developed at the same time, have been too often overlooked. Yet the cumulation of these so-called minor refinements has played no small part in making the modern machine tool the safe, accurate and efficient instrument it is. Inspired for the most part by the suggestions of operators, service men, sales engineers, and workmen on the assembly floor, these improvements have had a tremendous effect in increasing accuracy, reducing cutting time and generally lowering production costs.

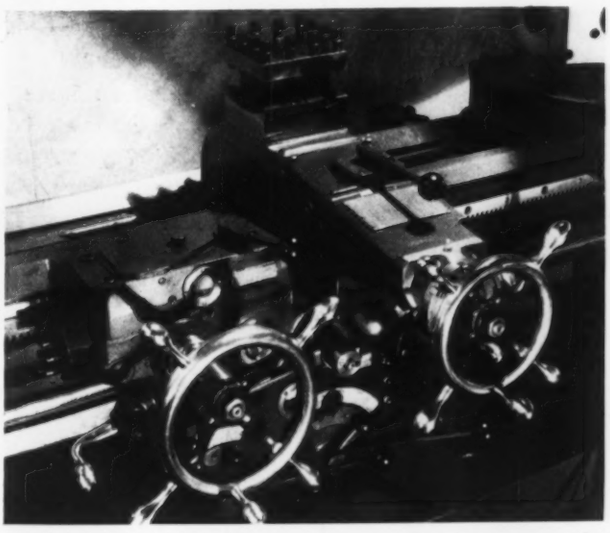


Fig. 2—Location of carriage controls has been determined by actually fitting them to operators

Not so long ago design and the location of turret lathe operating levers was a matter left almost entirely to the drafting room. The result was that mechanical expediency rather than the operator's anatomy received prime consideration. Operating levers on the modern turret lathe, however, revamped to the satisfactioin of a number of experienced operators who actually use them, are levers of logical size, shape, and location, as shown in *Figs.* 1, 2, 3 and 4. The hand grasps these levers instinctively instead of having to fumble around for them. In many cases, the hubs have broached, serrated holes, permitting easy readjustment; shanks of stiff steel rod; and brass-bushed bakelite ball ends similar to those of an automobile gear shift. Standardization has been accomplished through adoption of hubs with SAE standard broached serrations. This "tailoring" of levers not only has made the operation of the machines much more convenient, but it also has resulted in marked improvement in their appearance.

Mention should also be made of the further adapta-

tion of certain of the levers to the instinctive action of the operator. It is highly important that power feeds of carriage, cross slide and turret slide should knock off instantly, and, of course, that such control levers be locked to keep the power feed from kicking out prematurely under load.

To meet the instinctive action of the operator, which was shown by actual test to be in this case a downward sweep or slap with the palm of the hand, a lever was developed with bent handle which is illustrated in *Figs.* 2 and 4. When struck by the palm of the hand, this bent handle rolls slightly in its socket in the body of the lever, thereby camming the locking pin out of its seat and releasing the whole lever for its downward movement under the continued impulse of the hand. The operator gives no thought to unlocking, which is automatic as far as he is concerned. Engagement of the power feed is equally simple, involving a straight upward pull on the conveniently located and well-shaped handle, which is likewise automatically locked in place.

Oiling of Ways Is Automatic

Another important refinement in turret lathe design is in the lubrication of the sliding bearings between the bed and the cross slide and turret slide carriages, bearings which experience has proved are some of the most vital and at the same time most neglected on a turret lathe. To make sure the necessary drops of oil are fed to these way-bearings as needed, and only as needed, an oil reservoir and pumping mechanism has been built into the slide carriages. The reservoir is sealed to exclude coolant, and the pump is interconnected with the operating mechanism so that oil is fed to the ways only if and when there is movement of the carriages on the ways. The mechanism is also arranged to drop oil upon the power feed pinion when the feed is engaged. A bull's eye sight gage, visible directly above the left-hand wheel in *Fig.* 2 on the front of the apron, indicates clearly when the reservoir should be re-filled.

Fig. 3—Turret lathe headstock, showing grouping of the spindle controls and built-in pushbuttons

One of the greatest single minor refinements in design from the standpoint of improved appearance has been the adoption of socket head cap screws and set screws. This is clearly evident when the old and the new are directly compared as is possible between *Fig.* 2 (showing some of the new style screws) and *Fig.* 5 (showing old style). Socket head screws give a smoothness of outline to the entire machine which is impossible of attainment with the older type of screw. There are also decided practical advantages in the use of socket head screws, including reduced possibility of injury to operators, greater ease of cleaning the machine, and reduced cost of manufacture and assembly.

A good example of what has been done in building in an accessory is given by the flush-set pushbutton station located strategically at the front of the headstock casting, visible in *Figs.* 1 and 3. The wiring comes through the casting from the rear. Not only has the appearance of the machine been improved by pocketing the unsightly metal case, but adequate protection has been given a delicate mechanism, a dangerous projection has been removed, and tampering has been discouraged. The new location is also safer from the electrical standpoint and is convenient for operator.

Turret Has a Roller Bearing

As a result of analytical study of the main turret, a tapered roller bearing has been applied to its axis, this being illustrated in *Fig.* 5. While there is no constant movement on this bearing, it has been found to make turning much easier, especially when the turret carries a heavy load of tools and fixtures as is so often the case. The roller bearing also insures permanent precision of turret centering and it gives better seating action to the turret because the rollers break the oil film when binding.

Another minor improvement in the turret mechanism is the provision for automatic releasing and binding. On the back stroke of the slide, a latch under the turret encounters a dog which trips it and releases the turret binding ring, shown in *Fig.* 5. On the forward stroke the action is reversed and this split ring is tightened. This always gives exactly uniform turret binding action and at the same time has done away with the unsightly binding wheel or binding lever on top of the turret. Here it not only was inaccessible, but very much in the way of many of the modern tooling set-ups. Beyond all this, the elimination of two secondary motions in the indexing of the turret cuts down appreciably on the non-productive time of the machine and on the physical strain on the operator.

Because of the relative simplicity of the stock feed mechanism, the importance of this unit was long overlooked. Yet it was evident that undue physical effort was involved in closing the collet chuck on bar stock,

especially of late, with increasing speeds and feeds on tougher material demanding much more powerful gripping action. Rollers have been applied to the ends of the operating fork and operating fingers to give rolling instead of sliding action at these points of heavy unit load. Furthermore, an improved chuck operating spool was evolved. This has a dual angle surface—a steep rise at the rear to bring the chuck jaws down upon the work quickly, and a much more gradual rise, for the powerful leverage needed to insure firm gripping. These simple refinements in the stock feed mechanim were found in practice to diminish to a surprising degree the physical effort required to operate the chucking mechansm.

Self-supporting means for the power feed pinion in the cross slide mechanism is another simple turret lathe improvement which has brought highly desirable results. Instead of forcing the precision bearings of the

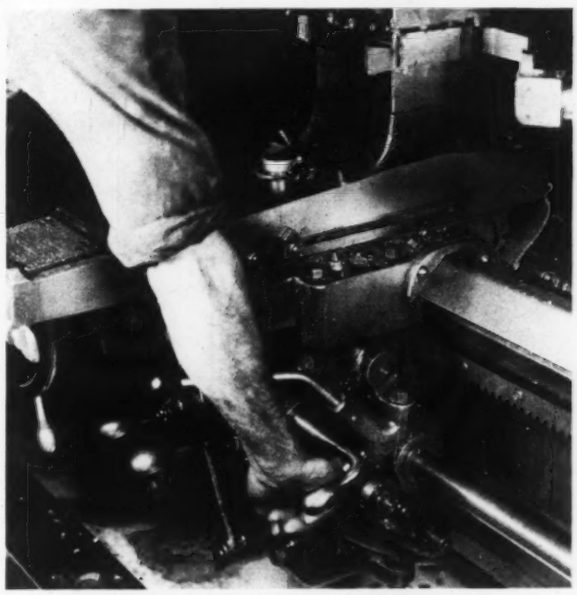


Fig. 4—Instinctive downward push knocks off longitudinal feed, and straight pull engages it

cross slide screw to support the pinion, independent bearings have been provided at each end of the pinion. This does away with all deflection of the accurate feed screw and consequent pinching and wear on its bearings. It also contributes materially toward smoothness of feed, through solid support of the pinion in proper mesh with its mating gear in the apron.

One of the effects of the tightening of the limits of accuracy has been the improvement of the micrometer dials on the cross feed screws. There was a time when comparatively small thimble-type dials reading to thousandths of an inch served the purpose. When limits to tenths of thousandths were demanded, however, these thimble dials proved wholly inadequate. The new type dials, one of which can be seen in *Fig.* 2, are of drum type and are of such generous diameter

Fig. 5—Turret turns freely on roller bearing but external ring binds it firmly to broad base

that split-thousandths can be read with ease. They also permit the use of spring clips through which several repetitive settings can be predetermined and marked. Roughing and finishing cuts, for instance, can thus be predetermined for a sequence of operations.

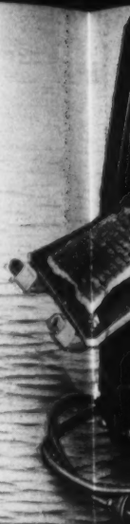
Typical of the almost endless number of minor refinements based on solid common sense and growing out of practical experience in the field, is the design of built-on eye-bolts on turret lathes. Since machine tools are more and more commonly moved and spotted by overhead cranes and heavy duty crane trucks, someone, very likely a sales engineer or demonstrator, conceived the idea of setting a heavy eye-bolt permanently into the top of the headstock casting, and a similar but readily removable eye-bolt in one of the cross members within the bed of the machine.

Similar eye-bolts also are provided in the heavier tools and tooling fixtures, by means of which these units can be lifted readily and swung safely into position with the help of crane facilities. These eye-bolts eliminate to a large extent the use of slings, bars, and jacks which previously were common sources of injury to men and machines in the process of moving equipment in industrial plants. In these days when machine tools so frequently are relocated to speed up the flow of work, this simple refinement is very important.

Only a few points in the array of minor improvements that have been made in turret lathe design in the last few years have been touched upon. Many others might have been mentioned—the standardization of cap and set screw, for instance, or the definite improvement in the design of safety guards, or even that simple expedient of providing hooked lugs on the front side of the headstock casting for the chuck operating wrench.

When considered individually, all these design refinements can be described merely as "evolutionary." Yet when considered collectively, over a period of years, they very obviously have had a decidedly "revolutionary" effect upon the art of cutting metal.

Dependability is obtained in fully enclosed Wilson welding machine, above, by improved engine idling device and double sediment collectors for carburetor. Low center of gravity and built-in lifting bail make the machine easy to move and handle



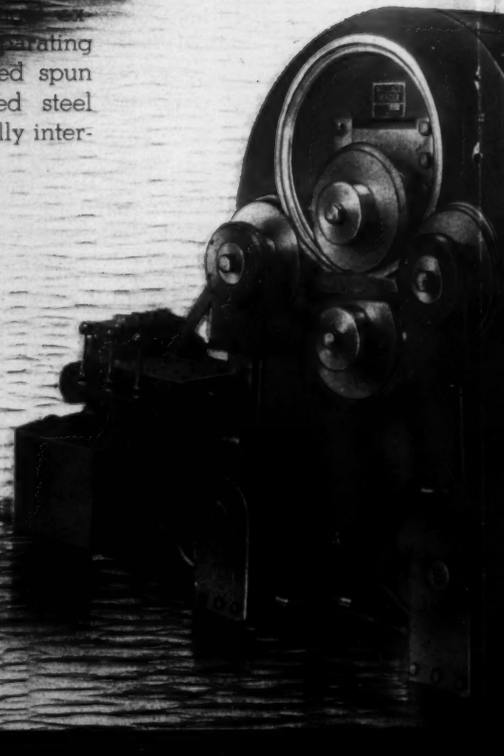
Motor is suspended in the Cube Steak machine, right, to give adjustment of tension on belt. Meat can be cubed to any desired thickness by simple regulation. Machine is finished in porcelain enamel and trimmed with chromium

Design F
In New M

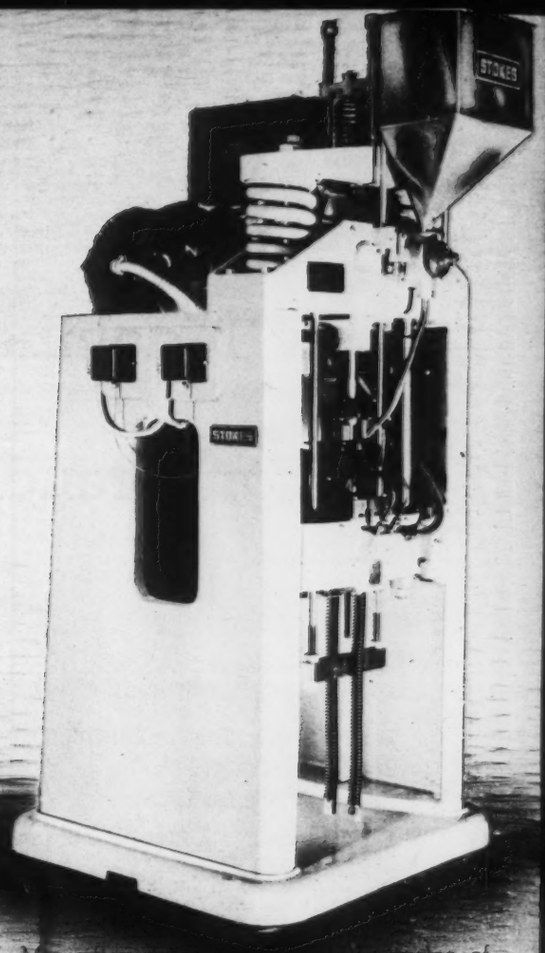
A Pictorial Presentation
from the Standp

Welded steel construction distinguishes the Colonial hydraulic press, below, capable of exerting 50 tons pressure. Large assembly work is easily handled yet there is little overhang in press gap to cause deflection of frame. Presses are designed for automotive assembly

Basket in [illegible] tractor, above, used for separating liquids from solids, is of tinned spun copper side sheet and tinned steel bottom. Cover is aluminum, fully interlocked for safety



Rubber printing forms are vulcanized in this Baldwin-Southwark press, below, by electrically heated plates. Pumping unit for producing hydraulic pressure and all electrical equipment are concealed in press frame. Machine will exert pressure of 120 pounds



n Features
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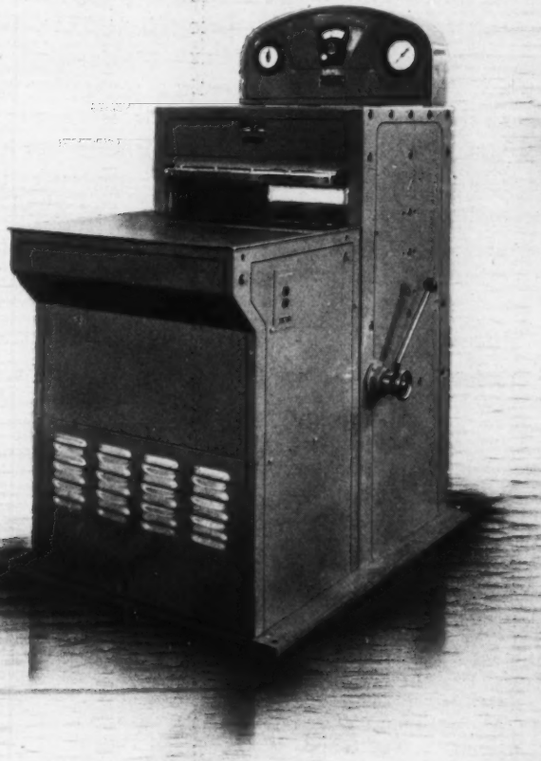
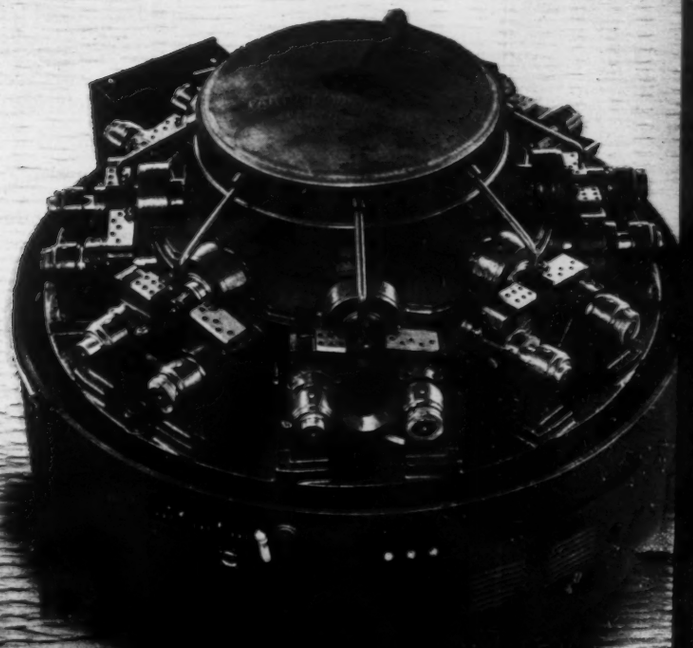
ntation of Recent Machinery
Standpoint of Design



Micro-[illegible] cycles of the fully automatic [illegible] plastic molding machine, above. Various safety devices make it practically impossible to damage mold or mechanism and machine stops, ringing warning bell if continuity of operation is interrupted

Lubrication of the Partool 8-spindle rotary lathe, below, is fully automatic. Coolant is pumped up to a reservoir on top for distribution to the work in proper quantities. Spindle motors are mounted inside the base. It is designed for turning automotive universal joints

Hydraulic power, controlled by conveniently placed levers, positions side rolls of the Wallace bending machine, left. Machine has direct motor drive to bending rolls. Structure is made entirely of rolled steel plates, arc welded together



New Machines Indicate Design Trends

AUTOMATIC or "robot" control is exerting its influence more and more in modern industry. Photoelectric devices, for instance, are finding many applications that speed up and increase the efficiency of production lines. Mechanical eyes such as these never fail to detect faulty parts, are not troubled with fatigue and do not receive injuries which would incapacitate workmen. If a photoelectric cell does go bad a signal is immediately flashed and repairs may be made before damage to machines or equipment takes place. Photoelectric control is, of course, one small phase of automatic control, but its possibilities are almost limitless. Counting, separating parts according to size or color, operating controls when conveyor mechanisms jam are a few uses. Light-sensitive devices have been used for some time for opening garage doors, on amusement apparatus and even for turning on buoy lights at night, when the absence of daylight operates them. Industry is finding they will add another step toward efficiency in machine operation.

Air Conditioning

Humidity Box, The Air Conditioning Supply Co., Cleveland.

Construction

Road mixer, Chain Belt Co., Milwaukee.
Mix-in-place road builder, The Jaeger Machine Co., Columbus, O.

Domestic

Spinner type washer, Westinghouse Electric & Mfg. Co., Mansfield, O.
Electric ironer, Norge Division Borg-Warner Corp., Detroit.
Range timer, Seth Thomas Clocks Div. of General Time Instruments Corp., Thomaston, Conn.

Excavating

Blade grader, Caterpillar Tractor Co., Peoria, Ill.
Air compressor, Schramm, Inc., West Chester, Pa.

Finishing

Portable electric airpainting unit, Paasche Airbrush Co., Chicago.
Metal depositing tool, Metals Coating Co. of America, Philadelphia.

Foundry

Wheelabrator Tum-blast, The American Foundry Equipment Co., Mishawaka, Ind.
Gyratory screen, The Beardsley & Piper Co., Chicago.
Wet sand cleaning method, The Hydro-Blast Corp., Chicago.

Industrial

Tapping machine, Procunier Safety Chuck Co., Chicago.
Degreasing machine, Detroit Rex Products Co., Detroit.
Portable Electric sander, Skilsaw Inc., Chicago.

Materials Handling

Electric hoist, Northern Engineering Works, Detroit.
Ladle handling lift truck, Towmotor Co., Cleveland.

Metalworking

Chaser grinder, Landis Machine Co., Waynesboro, Pa.
Precision lathe, The South Bend Lathe Works, South Bend, Ind.
Three-in-one contour machine, Continental Machine Specialties Inc., Minneapolis.
Hydraulic broaching machine, American Broach & Machine Co., Ann Arbor, Mich.
Hobbing machine, Barber-Coleman Co., Rockford, Ill.
Hydraulic press, A. B. Farquhar Ltd., York, Pa.
Heavy duty turret lathe, Gisholt Machine Co., Madison, Wis.
Power driven straightener, U. S. Tool Co. Inc., East Orange, N. J.
Two-wheel wet grinder, The Hisey-Wolf Machine Co., Cincinnati.

Office

Hand signer for checks, The Todd Co. Inc., Rochester, N. Y.
Intercommunication system, Conversafone Co., New York.

Oil Refinery

Blender, The Patterson Foundry & Machine Co., East Liverpool, O.

Packaging

Automatic liquid weigher, Richardson Scale Co., Clifton, N. J.
Packaging scale, Exact Weight Scale Co., Columbus, O.
Bag closing machine, Bagpak Inc., New York.

Plastic Molding

Automatic injection molding machine, Index Machinery Corp., Cincinnati.

Refrigerating

Purger for refrigerating systems, Frick Co., Waynesboro, Pa.
Refrigerant condenser, General Refrigeration Sales Co., Beloit, Wis.
Lightweight air compressor, Schramm Inc., West Chester, Pa.

Restaurant

Under-counter refrigerator, Westinghouse Electric & Mfg. Co., East Pittsburgh.
Electric dishwasher, General Electric Co., Nela Park, Cleveland.
Electric slicer, U. S. Slicing Machine Co., La Porte, Ind.

Textile

Stainless steel rayon and silk dye beck, Riggs & Lombard Inc., Lovell, Mass.
Electric cloth guider, H. W. Butterworth & Sons Co., Philadelphia.
Automatic shear, Curtis & Marble Machine Co., Worcester, Mass.
Package dyeing machine, Smith, Drum & Co., Philadelphia.
Inspecting and measuring machine, Hermas Machine Co., Hawthorne, N. J.
Bedspread loom, Crompton & Knowles Loom Works, Worcester, Mass.

How Redesign Can Help Resurrect an Entire Industry

INDEFINITE as some may think it, how much more uncertain would be the status of the street car today had it not been for redesign? And how much more difficult would be the job of redesign were it not for the acceptance of materials available with which to develop the street car into a passenger transportation unit worthy of the name?

Some three or four years ago, under the capable direction of C. F. Hirshfeld, chief engineer of the Transit Research Corp., extensive research and development pointed the way to holding and possibly enlarging existing street car traffic through the building of modern, practical cars. Of the many factors involved, the most important in redesign appeared to be the necessity for smooth running and the elimination of noise. How successfully these have been brought about is apparent to riders of the new cars now being utilized in many of the bigger cities. Equally obvious is the fact that the use of rubber and rubber-like materials have been the primary means of accomplishing the desired end.

It costs money to redesign. But to make money, money must be spent. All the publicity and selling in the world, no matter on what type of machine, will not help if design and development fall behind the times.

• • •

Series on Springs Scheduled

EARLY readers of MACHINE DESIGN will recall the series of articles "General Considerations in Designing Mechanical Springs," by A. M. Wahl, which appeared in the four issues from May to August, 1930. So great was the interest in these articles that reprints were run off for distribution in booklet form. These were quickly exhausted as well as were an additional final run of reprints, and many readers necessarily were disappointed through their inability to secure extra copies.

Testifying to the excellence of these articles and to the interest of chief engineers and designers in the subject of springs, is the fact that requests for reprints of the series are still being received—more than seven years after publication of the series! While this is, to say the least, gratifying to the editors, it is a matter of regret not to be in a position to meet the demand. The one course that seems to present itself in order to serve both old and new readers is to publish the series again in MACHINE DESIGN, with revisions and additions wherever necessary to bring the work up-to-date. This, therefore, is being planned, Part I of the series to appear in the January, 1938 issue.

Gear Meeting Paper Sheds Light on Tooth Pitting

PITTING of gear teeth has remained something of a mystery but its results usually lead to broken teeth. At the recent semiannual meeting of the American Gear Manufacturers association at Lake Wawasee, Ind. Dr. Stewart Way, of the research laboratories of the Westinghouse Electric & Mfg. Co. delivered a paper, "Rolled Tests to Determine Pitting Fatigue Strength," which clears up many points in connection with pitting. Roller pitting tests were used as pitting usually occurs near the pitch line of gear teeth where there is pure rolling contact.

In the tests rollers are run together in pairs, one of them being driven, and it in turn driving the other by traction on the contact area. The upper roller is mounted in a bearing block attached to a loading arm through which pressure is applied and measured.

Dr. Way declared that pits developed from pitting cracks, the latter starting in a surface layer less than 0.001-inch thick. It is not certain whether they start at the surface or below. However, the general direction taken by the cracks as they grow bears a definite relation to the rolling direction. Other conclusions were:

(1) Pitting cannot be produced without the presence of oil and if oil is added to a pair of rollers that has run dry at a load above the pitting limit for several million cycles, pitting will occur in a few hundred thousand additional cycles.

(2) The resistance to pitting was found to be practically independent of the viscosity of the oil for viscosities 400 to 2000 seconds at the operating temperature at a speed of 4000 RPM. For higher viscosities than 2000 seconds the pitting limit increases appreciably with increasing viscosity. The action of the heavier oils in discouraging pitting was found to lie in their prevention of the formation of pitting cracks, rather than in the prevention of growth of cracks to pits.

(3) The pitting limit was found to depend to a considerably degree on the surface finish, the finer finishes giving higher pitting limits. Increase in the pitting limit also was noted with increasing hardness.

A paper covering the relation between microstructure and machinability of alloy gear steel was presented at the meeting by Norman E. Woldman, chief metallurgical engineer, Eclipse Aviation Corp., East Orange, N. J. He pointed out that no one grain structure is best suited for all types of machining.

"Each machining operation in the manufacture of gears requires a specially designed tool, made from a required alloy and heat treated to a definite hardness. It is therefore obvious that there must be some difference in the behavior of each of these tools on the one grade of steel. In similar manner it is apparent that different structures of the same steel will react differently to the same cutting tools."

Results of Study Given

Conclusions of Mr. Woldman included: For SAE 3250 and SAE 4350 steels the quenched and tempered, fine grained spheroidized structure is best for automatic machining; for SAE 6150 steel the coarse-grained spheroidized structure, obtained by long annealing at about the lower critical temperature, is best for automatic machining; for all three of these steels, the laminated-pearlite structure, obtained by annealing above the upper critical temperature is best for broaching as well as gear cutting and for single point tool turning of the bevel faces of the gear; and, the spheroidized structure, obtained by long annealing at about the lower critical temperature is best for minimum distortion in hardening. The annealed laminated pearlite structure produced the most distortion.

Continuing a discussion on "Factors Influencing the Durability of Automobile Transmission Gears" given at the meeting last May, J. O. Almen, head of the dynamics department, research laboratories, General Motors Corp., described the methods for calculating stress in helical automobile transmission gears. A formula was also presented for the determination of the bending stress on spiral bevel gears. Although the data in this report, as indicated by Mr. Almen, is confined in application to automotive gears, the association plans further study to determine its value in connection with other types of gearing.

Professional Viewpoints

MACHINE DESIGN WELCOMES LETTERS SUITABLE FOR PUBLICATION

Other Factors Combat Progress

To the Editor:

THE article by B. J. Stern in the September issue of MACHINE DESIGN, though it contains material of historical interest, has little application at the present time because the obstacles that beset the path of technical progress today are of a very different kind.

There is a regrettable tendency to select illustrations for their human interest value rather than for their logical application. They make entertaining reading but mislead as to the future. Today we have to consider different sorts of reactions to the march of science. One from the general public, another from special interests. The skepticism which marked the general public's attitude a century ago has been completely reversed and we are all too ready to accept the new marvels of science, even before they have been proved. . . . .

Special Interests Oppose Change

The reaction of special interests to certain types of progress is perfectly natural. The National Resources Committee report, for example, mentions that the silk manufacturers declared at one time that rayon would prove to be only a transient fad. Only a decade ago a large manufacturer of ice declared that the electric refrigerator would prove to be only a passing fad with which his company need take little account. It is only natural that manufacturers and organized labor in the construction industry, for example, should not be too enthusiastic over methods of construction which will render existing plants obsolete or would materially change the status of construction labor. These obstacles, however, are not obstacles of basic prejudice. Indeed they exercise a restraining influence against too rapid a disturbance in the business economy.

The great progress made in recent years, and still under way, in railroad rolling stock, had its major stimulus in necessity, arising from competition with automobiles and busses. It may well be questioned whether similar progress would have been made under government ownership and direction. . . . .

Except for the temporary opposition of special interests, which is inevitable and not altogether to be condemned, public opposition to technical progress is not likely to be found in the realm of inorganic science. It is more likely to be found as engineers leave their purely material applications of science and extend scientific methods to problems of economics, government and social welfare. An instance may be taken from county government. The governmental structure of Westchester county, N. Y., is an inheritance from one hundred and fifty years ago when conditions were totally different. It is cumbersome and extravagant. It is utterly unscientific. Yet, there is much opposition to its change. The general public is apathetic. Taxes resulting from extravagant multiplication of local governments have long been regarded as a necessary and unavoidable evil. There is no method, as in industry, whereby competition can force obsolescence by offering the public something better. . . . .

Innumerable examples might be taken in the application of medical and chemical science to human behavior, the problems of crime and delinquency, the problems of poverty and the shift of populations, the problems of class hatred and international rivalries. In such fields will be found the major obstacles in the future to technical progress. People will readily enough accept the new marvels in dead materials and in vibrating electrons, but they will be slow to accept the new knowledge about themselves.

—CARL F. SCOTT

Reader Disagrees with Writer's Views

To the Editor:

MR. STERN'S disquisition in your September issue on obstacles which oppose the introduction of meritorious inventions appears to have been tainted by his association with a certain clique of "social scientists." The implication in the concluding paragraphs that capitalist economy and the profit system stifle invention is merely a dogma of the Marxian breed and does not accord with common knowledge.

As an inventor myself and as an advertising agent who has participated in the commercial introduction of numerous inventions, I would point out that desire for profit has been the determining stimulus to the

(*Continued on Page* 94)

Men of Machines

MACHINERY and Allied Products institute, the national trade association of machinery manufacturers, has as its new president William J. Kelly, one of the younger industrial executives of Chicago. He succeeds John W. O'Leary.

Mr. Kelly, who is president of Arthur J. O'Leary & Son Co., manufacturers of iron and steel products, and director of Williams Sealing Corp., was active in organizing the institute in 1933. This association, which has carried out important studies on distinctions between business cycles involving "durable" and "consumption" goods, and on relations of machinery to employment and the American standard of living, has been credited with an important part in post-depression rehabilitation of the machinery building industries.

WILLIAM J. KELLY

• • •

C. CLARKE WALES

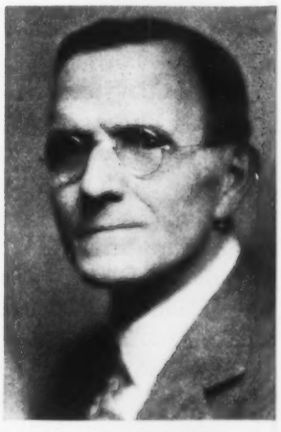
RECENTLY appointed assistant general manager of Algoma Steel Co., Sault Ste. Marie, Ont., C. Clarke Wales is a man of broad experience, both in metallurgy and design of steel mill equipment.

Born at Sharon, Pa., in 1900, Mr. Wales graduated from University of Toronto with bachelor of science degree in mechanical engineering. Following graduation he joined Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. In 1925 he became assistant chief metallurgist of the Otis Steel Co., Cleveland, later being made superintendent of the open hearth blooming mill and bar mill departments. Mr. Wales was promoted to chief engineer of the company in 1929 and in that capacity planned and supervised the construction of the 72-inch hot and cold strip mills now operating in the Otis plant.

• • •

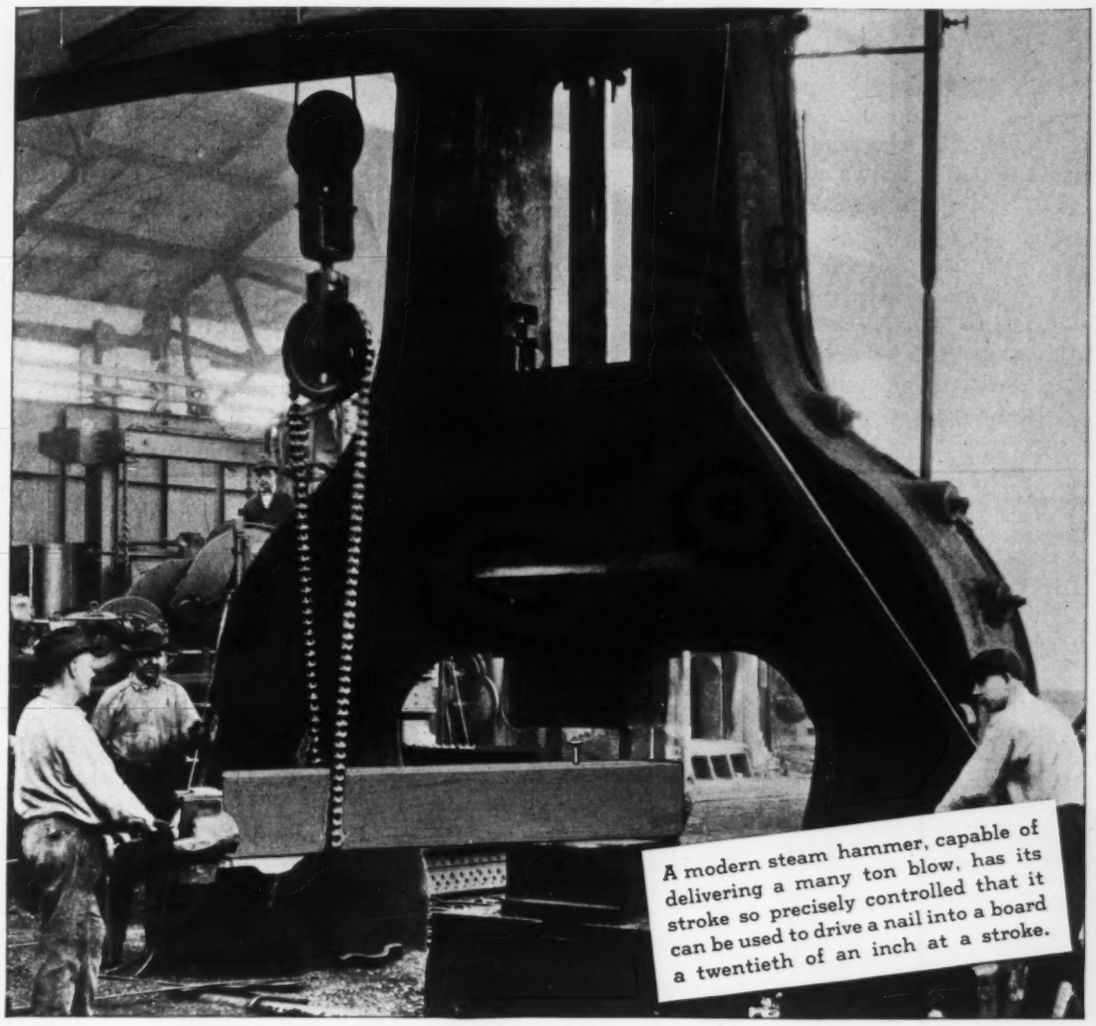
ANNOUNCEMENT is made of the nomination of C. W. Spicer of Toledo, O., prominent inventor and manufacturer, for the presidency of the Society of Automotive Engineers.

Clarence Wilfred Spicer was born at Edelstein, Ill., in 1875. Between 1890 and 1900 he studied at Alfred university, Alfred, N. Y. He received his mechanical engineering degree at Cornell in 1904. In 1935 Alfred university, of which he is treasurer, conferred upon him the honorary degree of Doctor of Science. Mr. Spicer initiated production of his patented universal joints in 1904 and in 1905 organized and became president of the Spicer Universal Joint Mfg. Co. He was president of the Spicer Mfg. Co., 1910-14, of the Spicer Mfg. Corp., 1914-15, and since 1915 has served continuously as vice president of the latter organiza-



CLARENCE W. SPICER

ALL MACHINERY IS DEVELOPING SUPER-PRECISION



A modern steam hammer, capable of delivering a many ton blow, has its stroke so precisely controlled that it can be used to drive a nail into a board a twentieth of an inch at a stroke.

● In all machine tools, and especially those involving rotating parts, progress demands greater precision. Spindle rigidity in lathes, grinders, hobbers, drills and boring tools is largely dependent on the bearings. And as higher speeds and fine surface finish demand the rigidity and efficiency of ball bearings, future development of these tools depends on increased ball bearing capacity and accuracy.

In M-R-C Super-Precision ball bearings extremely high accuracy is achieved. The outside diameter, bore and race grooves are held to concentricity tolerances of only a few 10,000ths of an inch. Ball diameters and sphericity are held within a few 100,000ths.

While the extreme accuracy of M-R-C Super-Precision Ball Bearings is not necessary in all M-R-C Bearings, the quality and precision of all M-R-C Ball Bearings reflect the methods developed to attain Super-Precision accuracy. Every M-R-C Ball Bearing is a better bearing than it would be if M-R-C Super-Precision Bearings did not exist.

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tion. As a member of the Corps of Designers, Class B, he played a part in the development of the Liberty Truck for the U. S. War department.

In addition to universal joints, Mr. Spicer has invented a method of hydraulic push broaching of square and multiple splined holes; a gear drive system for railway cars; lighting generators; and air conditioning equipment. He is a member of a number of technical societies in whose affairs he takes active interest, especially in matters of standardization.

♦ ♦ ♦

S. L. NICHOLSON, who recently retired from the Westinghouse Electric & Mfg. Co. after many years of service, has been elected honorary life member of the American Gear Manufacturers' association, of which he was one of the founders.

♦ ♦ ♦

H. I. HAZZARD, formerly with the passenger car division, Lycoming Mfg. Co., has been appointed chief engineer of American Bantam Car Co., Butler, Pa.

♦ ♦ ♦

ROBERT BISCHOFF has been put in charge of all valve engineering activities of the Western Gas division of the Koppers Co. at Fort Wayne, Ind. Mr. Bischoff was formerly engaged in the development and manufacture of hydraulic turbines in Switzerland.

♦ ♦ ♦

GEORGE T. HORTON, president of the Chicago Bridge & Iron Works, has contributed $20,000 to Rensselaer Polytechnic institute, of which he is an alumnus, for the establishment of a welding laboratory.

♦ ♦ ♦

WILLIAM C. CARTER and EDWARD J. BURNELL, both of whom came with the company as draftsmen, have been elected vice presidents of Link-Belt Co., Chicago. Mr. Carter, mechanical engineering graduate of University of Illinois, has been with Link-Belt since 1902. Mr. Burnell, a graduate mechanical engineer from Lehigh university, joined the company in 1913.

♦ ♦ ♦

DR. ARTHUR SIMON, for nearly 35 years with Cutler-Hammer Inc., in various executive engineering capacities, has established an office of his own in Milwaukee as engineering consultant and patent attorney. Dr. Simon continues his connection with Cutler-Hammer as consulting engineer and patent expert.

♦ ♦ ♦

C. P. RANDOLPH, formerly chief engineer, Edison Electric Appliance Co., Chicago, has been advanced to the position of vice president in charge of engineering.

♦ ♦ ♦

DR. JOHN CHIPMAN has been appointed professor of metallurgy, Massachusetts Institute of Technology. Dr. Chipman has been active in research work for 10 years, as research engineer at the University of Michigan and since 1934 as associate director of research for the American Rolling Mill Co., Middletown, O.

♦ ♦ ♦

J. B. DYER has been appointed chief engineer of the electric washer and laundry equipment department of the Frigidaire division of General Motors Corp., and F. H. MCCORMICK has been named chief engineer of the electric range engineering department.

Obituaries

COL. CLARENCE R. FALK, secretary and treasurer of the Falk Corp., Milwaukee, since 1923, and nationally known as a manufacturer and pioneer aviation enthusiast, died recently.

He began his business career in a bank, then was dramatic critic on a newspaper, and finally entered the industrial field with the Cloos Electrical Engineering Co. He had been with the Falk Corp. since 1901, and had served as works manager and as vice president.

♦ ♦ ♦

ERNEST J. LEES, vice president and chief engineer of the National Tool Co., Cleveland, died in that city on Sept. 27.

Mr. Lees, widely known for his inventions in the field of gear cutting machinery, was born in England. He came to the United States as a young man and was employed on engineering work in Rockford, Ill., and Franklin, Pa. He located in Cleveland in 1912, where he was a co-founder of the Lees-Bradner Co.

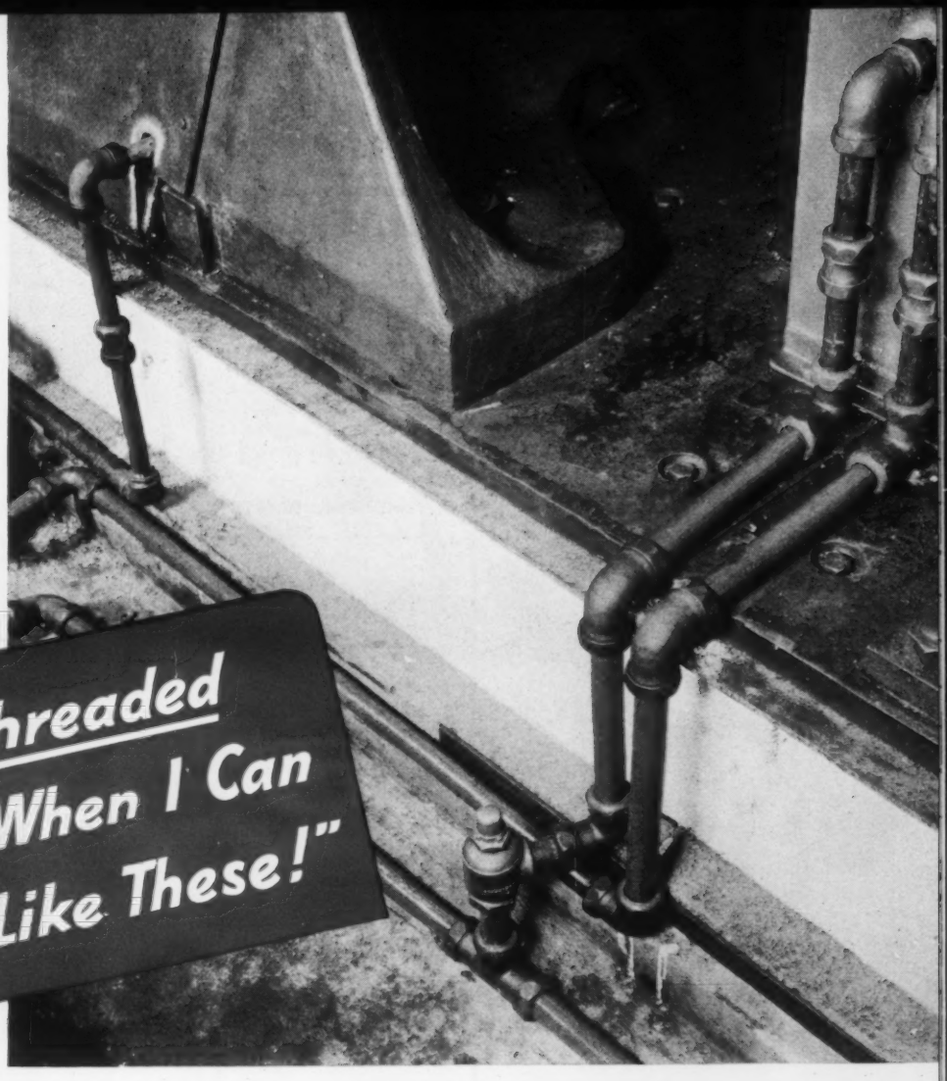
♦ ♦ ♦

PERCY C. BROOK, executive vice president of Fairbanks, Morse & Co., Chicago, died Oct. 15. Born in Memphis, Tenn., Mr. Brooks graduated with the first class of Georgia Technical institute at Atlanta. He then became associated with the Atlanta Machine Co., and in 1898 joined the Fairbanks company as assistant to the general manager of the main works, later becoming acting manager. In 1910 he was placed in charge of the then established Canadian works and continued in this capacity until 1910 when he was made vice president.

♦ ♦ ♦

CHARLES L. TOLLES, pioneer Wisconsin industrialist, died at his home at Eau Claire, Wis., where he was born and where for 50 years he was an executive of old Phoenix Mfg. Co., manufacturer of logging and sawmill machinery, until it ceased operations in 1923. Mr. Tolles is credited with developing the first steam-driven crawler type tractor in association with its inventor, a Mr. Lombard of Waterville, Conn., in 1903.

Oil-feed and -return lines on lubrication system of industrial gas-engine. Joints were made quickly, easily, and permanently on *plain-end* pipe with Dresser Fittings, Style 65.



"Me Specify Threaded Joints? Not When I Can Get Fittings Like These!"

Why specify threaded piping? In less than a minute using only a wrench—permanent, oil-tight, gas-tight, flexible joints can be made on *plain-end* pipe with Dresser Fittings, Style 65. No threading or "doping" is required. Just stab in the pipe and tighten the end nuts (see sketches below and cross section at edge of page.)

Pipe Joining Simplified Throughout

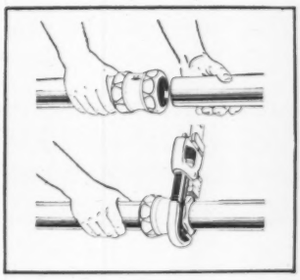
Dresser Fittings, Style 65, not only eliminate threading, but offer many other advantages as well.

Each fitting acts as a union; the line can be broken at any point, and fewer fittings are needed.

Exact pipe or nipple lengths are unnecessary because the body of the fitting spans minor variations in space between pipe ends.

Wall thickness at pipe ends is not reduced. Pipe has full strength. (Threading weakens pipe by approximately 40%).

Moreover, the *flexibility* of the special-compound, everlasting rubber gaskets *absorbs* and *cushions* vibration, expansion, contraction, and slight misalignments of the pipe—eliminating stresses that often cause failures with rigid joints. On test, one stock "65" Fitting was deflected 120,256 times through a 4° arc under a pressure of 100 lbs. per sq. in. with no sign of leakage.



Each gasket is fully impervious to line contents, and is equipped with a metallic "armor" for double protection.

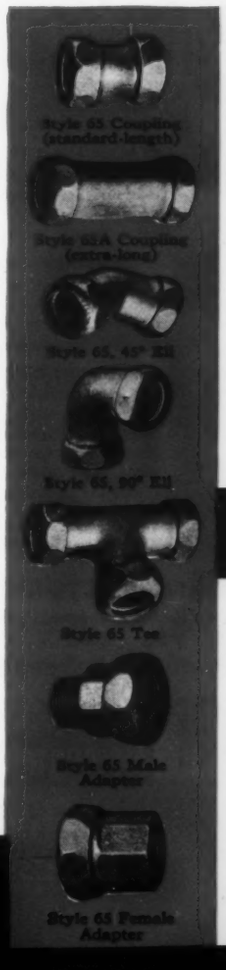
And every Dresser Fitting is completely demountable—can be salvaged for re-use time after time.

Dresser Fittings, Style 65, are not new. They have been in use for over 18 years and employ the same *proved* working principle found in the famous Dresser Bolted Couplings, which today join more than 150,000 miles of gas, water, and oil lines.

For These Uses!

Scores of design engineers are now specifying these Fittings, Style 65, for pipe connections on new machinery and equipment—both to speed up production assembly and facilitate piping work after installation. The Fittings are especially recommended for oil, gas, water, hot-water and air lines, at pressures up to 150 pounds per square inch or more. On many other services, they are equally satisfactory. Details on request.

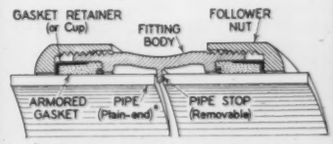
Send coupon today for FREE sample!



WORKING PRINCIPLE

Dresser Fittings, Style 65

End nuts, when tightened up with an ordinary wrench, cause *resilient* gaskets (made from a special rubber-compound) to compress tightly around the pipe, effectively sealing the joint but providing an essential *flexibility* to absorb pipe vibration, expansion, contraction, misalignments, etc.



* Threaded or beveled pipe can also be used.

Free! SEND COUPON FOR SAMPLE FITTING

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Send me, without obligation, free sample of your Style 65 Fitting.
SIZE (circle one): ⅜"; ½"; ¾"; 1"; 1¼"; 1½" or 2" I.D.
FINISH: Black ☐; or Galvanized ☐
SERVICE desired for:
Oil ☐; GAS ☐; Air ☐; Water ☐

Jobber's Name.....
and Address.....
My Name.....
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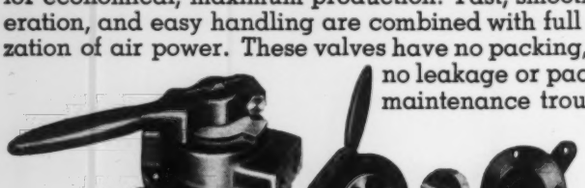
DRESSER FITTINGS Style 65

Improve Operation of Air Equipment

Hannifin disc-type Air Control Valves give the positive and accurate control of air operated equipment needed for economical, maximum production. Fast, smooth operation, and easy handling are combined with full utilization of air power. These valves have no packing, and no leakage or packing maintenance troubles.



● **SIMPLE "PACK-LESS" DESIGN:** Hannifin disc-type valves have but four parts and a handle—there is no packing. The bronze disc is ground and lapped to make a perfect seal with the seat. Re-lapping at long intervals maintains efficient, leak-proof operation.

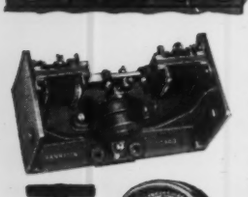
● **STANDARD HAND CONTROL VALVES:** Four-way type for control of double-acting cylinders, for air or hydraulic pressures to 150 lbs./sq. in. Four standard types, 45 or 90 degree movement. May also be used for three-way control of single-acting cylinders. Also duplex types for control of two double-acting cylinders.

● **PEDAL OPERATED VALVES:** Operator's hands are free for other work. With 45 degree movement, no shut-off position. With 90 degree movement, both outlet and exhaust closed in neutral. May be used as a throttling valve.

● **SPRING RETURN VALVES:** Give instant reversal of cylinder upon release of pedal. With 45 degree movement, no shut-off position.

● **ROTARY TYPE VALVES:** Heavy duty foot operated ratchet action. One pressure operates the cylinder, second pressure reverses the cylinder.

● **MANIFOLD TYPES:** Concentrate control of several cylinders, with easier handling and simplified piping. Four standard types, 45 or 90 degree movement, and spring return types, for various cycles of control.



● **ELECTRIC TYPES:** Single and double electrically operated valves for remote control, time cycle operation, four-way control, for a variety of standard and special applications.

● **PRESSURE REGULATING VALVE:** A spring loaded piston type pressure reducing valve, correctly designed for accurate, sensitive, automatic control. Instantly adjusted to provide the most economical working pressure for any individual machine or operation.

Write for Valve Bulletin 34-MD with complete listings of all types

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HANNIFIN "Packless" AIR CONTROL VALVES

Noteworthy Patents

JOHN O. ALMEN of Royal Oak, Mich., has assigned to General Motors Co. his patent No. 2,076,057 covering what he calls a "race and roller" transmission mechanism. The' sectioned elevation and interior end view which appear herewith as *Fig.* 1 make clear the origin of the name of this device

The mechanism consists of coaxial races between which are rollers held in firm tractive contact with the races — this pressure being varied automatically by cams in accordance with torque requirements. The axial force applied to the races, and tending to squeeze them together against the rollers, is in response to the sum of the tangential forces exerted by both the driving and the driven races.

The transmission is so designed that both frame and housing are relieved of strains due to the action of squeezing the races together. Within the

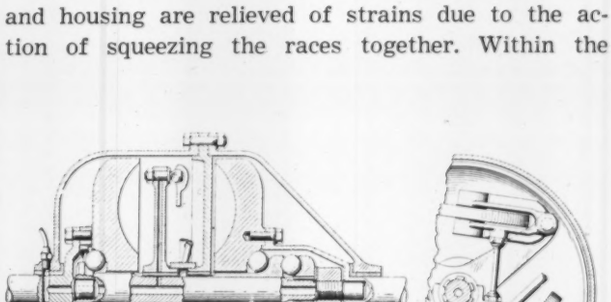

Fig. 1—*Adjustable rollers squeezed between races give infinitely variable speed between limits*

casing is a short nonpower transmitting shaft which bears the brunt of the reaction due to the squeezing together of the races. This reaction is taken through sturdy ball thrust bearings. The rollers are supported in forked carriers universally jointed to the arms of a spider.

The transmission illustrated is of infinitely variable ratio within the limits of its design. While various means can be utilized for controlling the ratio of the rollers, the design shown embodies a ratio control collar which is link-connected by universal joints to each of the roll carriers. This collar is mounted co-axially with the central shaft, adjusting movement being imparted to the control collar from the exterior by means of a master con-

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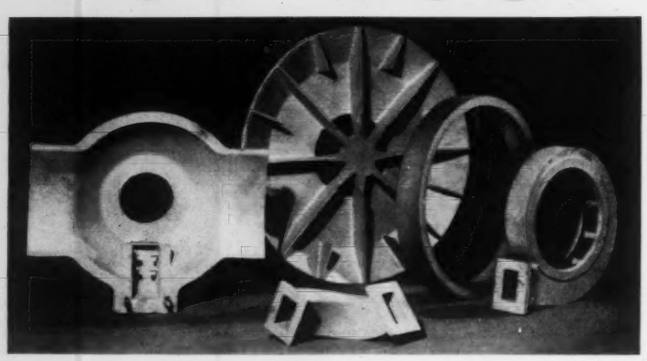
CUT COST



INCREASE PROFIT WITH DOWMETAL CAST BY WELLMAN

Elimination of useless weight through the installation of Dowmetal parts—one-third lighter than aluminum—makes it possible to increase the cycle of operation in your machines.

Cost of operation is further reduced because the machine can be started and stopped with considerably less energy.

Dowmetal—Industry's light-weight champion—greatly diminishes the starting and braking shocks of rotating parts to the other parts of a machine, thus increasing the machine's life and cutting maintenance and replacement costs.

Truck and machinery manufacturers are replacing costly dead weight with profitable pay load weight by using motor castings, transmission cases, oil pans, and other parts cast in Dowmetal by Wellman.

Wellman engineers invite you to consult with them on the many money-saving uses of Dowmetal as it may be applied in your business.

BENT TUBES • MACHINED PARTS
PLATED PARTS • CASTINGS

The WELLMAN
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trol link. This ratio control is not however claimed as a part of the present invention, having been covered in a related patent.

Inasmuch as the housing is not subjected to the axial forces applied by the torque-loading means, this transmission may be completely assembled and adjusted outside its housing, thereafter being encased in the housing as a unit ready for operation.

Defeats "Contact Line Wear"!

PATENT No. 2,090,934, granted to Walter Borenstein and Frank Basteni, covers a development in clutches such as are used for intermittent driving of the high speed shafts in sewing machines and the like. The principle of the clutch is shown in *Fig.* 2, an enlarged detail of one of its roller detents of which there are three or more.

One of the objects of this invention is to overcome the formation in the wedging surfaces of depressions or pockets due to digging in of the roller detents. Another object is to provide members of sectional character capable of easy replacement. The clutch described in the patent consists of a relatively thin disk having a cavity in its face about 2 inches in diameter. In this cavity is a smaller notched disk called a detent carrier.

In these notches are the detent assemblies consisting of a pivot roll, a notched contact block resting thereon, a detent roll, and a plunger and spring which keeps the detent roll pressed forward so as always to be in contact both with the wedge blocks and the inner surface of the annular rim of the large disk.

In the design of this clutch the carrier element and the bore of the outer plate are purposely made eccentric to each other to a degree which causes about ⅛-inch movement of the detent in relation to the normal wedging surface of the carrier member against which it impinges. It has been found that for sewing machine clutches this calls for eccentricity of from 3 to 7 thousandths of an inch. The effect of this is to distribute the wear on the surface of the blocks over an area, instead of concentrating it on a single contact line as otherwise would be the case.

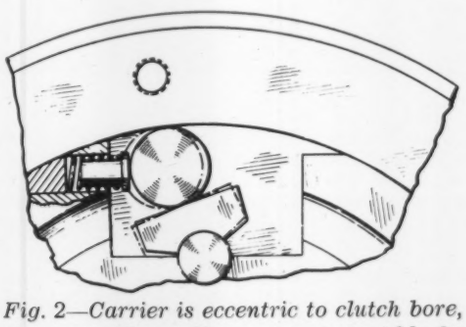
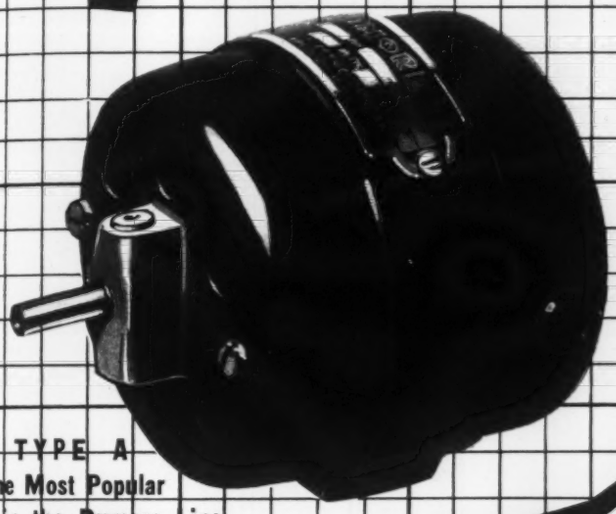
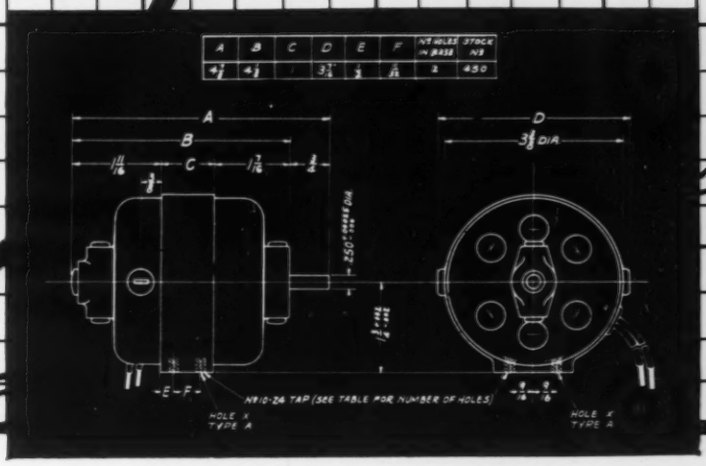


Fig. 2—Carrier is eccentric to clutch bore, thus spreading roll wear on contact blocks

HERE'S WHY YOU GET MORE *Power Hours* IN A DUMORE MOTOR



TYPE A
The Most Popular Motor in the Dumore Line



SPECIFICATIONS
TYPE A MOTOR

Class of Motor	Plain Series (Universal)
Construction Details—	
Degree of Enclosure	Open
Method of Cooling	Internal Fan
Bearings	Composition Bronze
Lubrication	Wick feed from oil wells
Direction of Rotation (Commutator End)	Clockwise
Housing Material	Cast Iron
Weight	3 lb.

Rating (Full Load, Continuous Duty)	A.C. Operation	D.C. Operation
Volts	115	115
Amperes	.72	.80
Watts, Input	69	96
Horsepower	1/30	1/20
Torque (Lb.-Ft.)	.027	.048
Full-Load R.P.M.	7,000	6,000
No-Load R.P.M.	20,000	20,000
Efficiency	39.5%	42.5%
Duty	Continuous	Continuous
Temperature rise	40°C.	40°C.

TYPICAL APPLICATIONS

Blowers
Motion Picture Projectors
Embroidery Machines
Yarn Testers
Surgical Pumps
Commutator Undercutters
Jewelers' Lathes

POSSIBLE MODIFICATIONS*

Other than 115-volt winding
C.C.W. or reversible rotation
Other than standard rating
Shunt winding for d.c. service
Other than standard shaft extension
Other than standard housing finish
Cast aluminum housing

*Note:—All modified motors are special. Prices on request.

Dumore motors *definitely differ* from ordinary motors —*Vibration is eliminated* by dynamically balancing armatures at high speed—*Five-time inspection* of parts, plus engineering inspection assures utmost accuracy —*100% electrical contact* of commutator leads is assured by special Dumore swaging—*Brush life is increased* by grinding commutator concentric with bearings—*Forced ventilation* is built into motor—*Centrifugal breathing is eliminated* by expanding armature windings at high speed and then sealing—*Wide selection* allows for meeting exact requirements (1/500 to ¾ h.p.—A.C. or D.C.—0 to 60 cycles); "Tailored-to-fit" parts may be had for special adaptations.

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FRACTIONAL HORSEPOWER
MOTORS

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★ NEWARK, N. J.	191 Market St.
★ BOSTON, MASS.	72 Summer St.
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★ LOS ANGELES, CAL.	818 Santee St.
★ SAN FRANCISCO, CAL.	638 Mission St.

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Assets to a Bookcase

Who's Who in Engineering

Edited by Winfield Scott Downs; published by Lewis Historical Publishing Co. Inc., New York; available through MACHINE DESIGN *for* $10.00 *plus* 15 *cents postage.*

This is the fourth edition of a biographical reference work which has become thoroughly established as an authority on the personnel of the engineering profession. The American Engineering council, through an advisory committee, has governed the professional aspects of this work.

Until the undertaking of this issue the book had not been revised since 1931, hence it was necessary to make a complete re-canvass of engineers. The new edition contains carefully checked professional records of 12,000 engineers, this representing an increase of 14 per cent over the number represented in the 1931 edition.

□ □ □

Manual of Gear Design

By Earle Buckingham; published by The Industrial Press, New York; available through MACHINE DESIGN *for* $2.50 *plus* 15 *cents postage.*

This constitutes Section 3 of a series which bears the stamp of approval of the American Gear Manufacturers association. The author, who long has been a familiar figure to the readers of MACHINE DESIGN, is professor of mechanical engineering at Massachusetts Institute of Technology, and a leading authority on design of gearing.

The book is devoted to helical and spiral gears. Definitions of terms and standard symbols are given first. Then comes a section on helical gear mathematics with detailed solutions of numerous general problems of helical and herringbone gears. In every case a definite example has been used to illustrate the solution.

Next are presented applications of various standard tooth forms to helical gears, followed by design of internal helical gears with tooth forms produced by standard cutters only, together with applications to differential and planetary drives. Tooth loads, both of metallic and nonmetallic gears, are covered. Spiral gears and their mathematics, including application to them of the 14½ degree tooth form, and their capacities also are dealt with.

Tabular arrangement is unusually good, all tables

TO HELP YOU SELECT THE MOST EFFICIENT DRIVE

Typical Uses for Diamond Roller Chain Drives
Typical Arrangements of Standard Attachments
1/2" Pitch
ASA No. 40
Diamond No. 66
Data and List Prices for Single and Multiple Strand Chains
Power Transmission Capacities (H. P. - R. P. M.)

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INSTALL Farval Centralized Systems of Lubrication on the machines you design and build, and you and your customers can rest assured that no bearing will suffer from lack of lubrication. Because each point on all Farval-equipped machines is served positively, correctly, regularly from one safe, central point.

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Affiliate of The Cleveland Worm & Gear Company, Manufacturers of Automotive and Industrial Worm Gearing.

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Special Delivery to Every Bearing

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□ □ □

How to Make Alignment Charts

By Merrill G. Van Voorhis; published by McGraw-Hill Book Co. Inc., New York; available through MACHINE DESIGN *for* $2.50 *plus* 15 *cents postage.*

The purpose of this book is to provide instruction on how to make nomographic or alignment charts for the solution of engineering and other formulas. That the possibilities of such methods of graphical solution are becoming better understood and appreciated by engineers and designers is indicated by the frequent contribution of useful nomograms to MACHINE DESIGN, and the active interest shown therein by readers.

Mr. Van Voorhis makes his presentation with minimum of text and maximum of illustrations, which in the case of this graphical subject is quite as it should be. The subject can be approached either through plane and analytical geometry, or through determinants. The author favors and uses the first mentioned approach, on account of the fact that the subject of determinants is a relatively unfamiliar branch of mathematics.

□ □ □

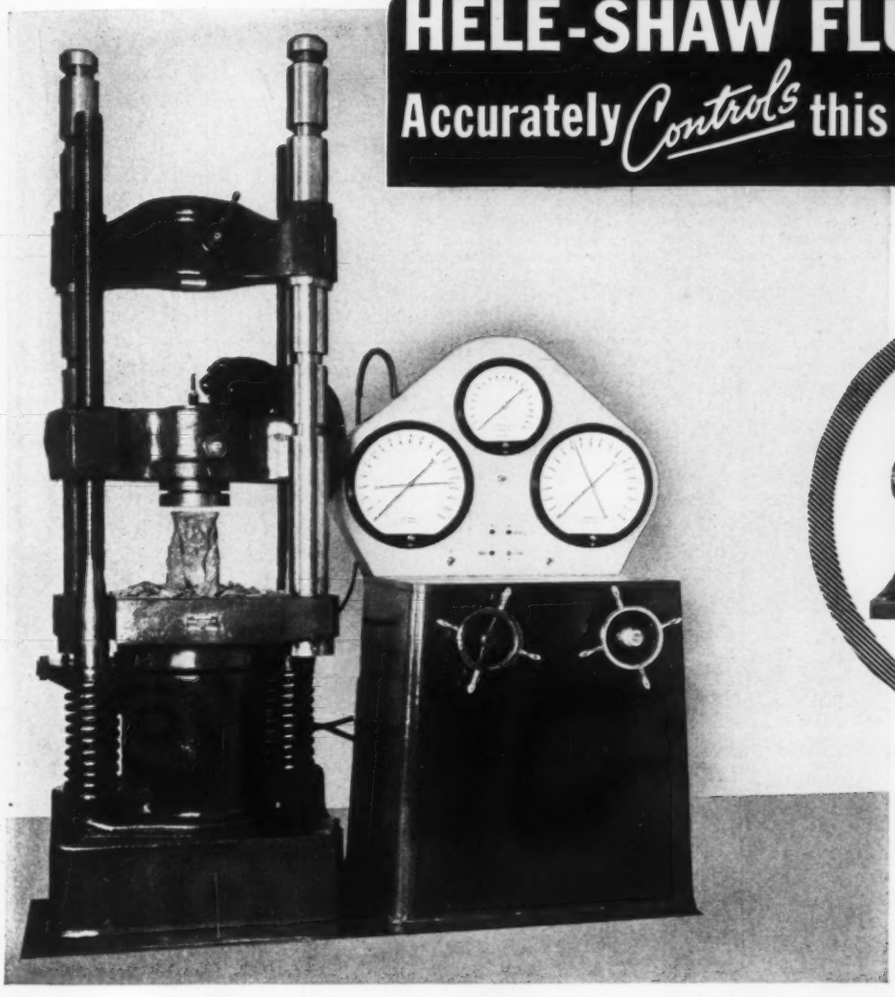
Ingenious Mechanisms for Designers and Inventors

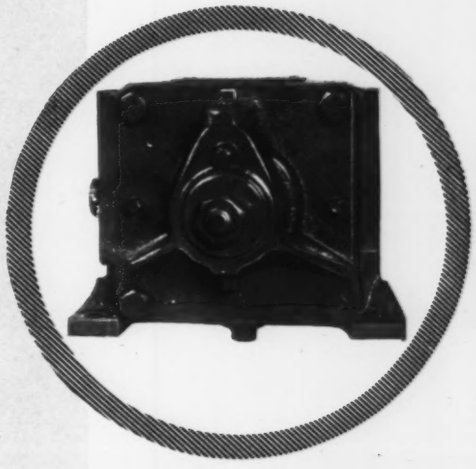
Edited by Franklin D. Jones; published by The Industrial Press, New York; available through MACHINE DESIGN *for* $5.00 *plus* 15 *cents postage.*

Like its companion Volume 1, which was reviewed in MACHINE DESIGN in December, 1930, this book is full of thoroughly practical mechanical ideas for designers and inventors. It is not a revision of the first volume, but is made up of a great number of additional illustrated descriptions of successful mechanisms and mechanical movements which were not available to the author when the other treatise was compiled. Thus the two volumes, taken together, constitute an unusually complete work of reference on the important subject of mechanism.

The book bears down particularly on ways and means of attaining automatic or mechanical control. Its 527 pages are profusely illustrated by line cuts which exemplify the best in modern technique of assembly and sub-assembly drafting practice.

HELE-SHAW FLUID POWER
Accurately *Controls* this Testing Machine





This illustration is actually one-fifth the size of the Hele-Shaw Pump that powers the 300,000 lb. Southwark-Emery Testing Machine.

This 300,000 pound Southwark-Emery Universal Testing Machine crushes concrete specimens or pulls apart steel bars . . . The ease with which it performs these tasks compels you to ask "How is it done?" . . . It's *done* with Hele-Shaw Fluid Power. A small Hele-Shaw Pump, occupying a space only 10" x 9⅛" x 7⅝", sends *Fluid Power* (oil under high pressure) to the testing machine. Hele-Shaw Fluid Power is subject to exceptionally accurate control. A touch on a handwheel applies Hele-Shaw Fluid Power g-r-a-d-u-a-l-l-y, precisely, to the specimens. This is necessary to simulate actual loading conditions or to duplicate testing conditions in order to permit accurate comparison of various samples. Hele-Shaw Fluid Power is widely used in hydraulic press-type machines because of its high pressure and because it is so readily controlled either manually or automatically. Rams driven by Hele-Shaw Fluid Power can be adjusted over a wide range of speeds . . . and can be stopped or started instantaneously. Look into the many advantages of Hele-Shaw Fluid Power for producing and accurately controlling linear or rotary motion . . . motion which may be varied in both speed and direction. Our new catalog gives detailed information. Write for it.

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A-E-CO HELE-SHAW PUMPS, MOTORS AND TRANSMISSIONS

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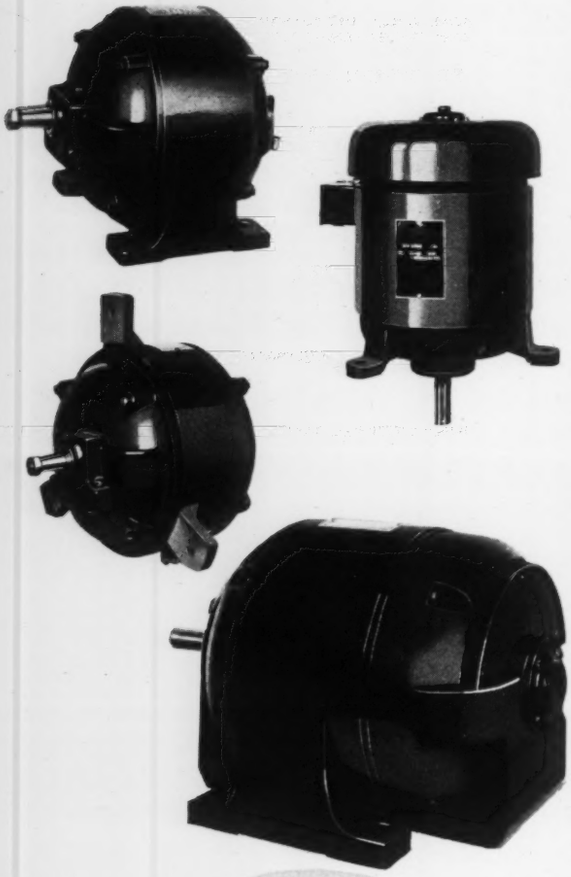
MOTORS

of Special Design



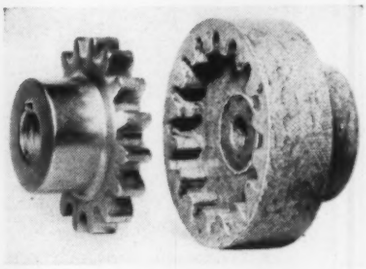
TEXTILE loom motors; splash-proof motors for dairies and wet places; vertical motors—these are only a few of the special designs Peerless has available. Peerless builds special motors for grinders, pumps and equipment of all kinds Range of sizes 1/4 to 10 horsepower Send us your drawings and specifications.

THE *Peerless* ELECTRIC CO.
WARREN, OHIO

NEW *Materials and Parts*

Fiber Coupling Is Developed

LIGHT weight and electrical insulation are two important features of the new Celoron flexible coupling placed on the market by Continental-Diamond Fibre Co., Newark, Del. The coupling weighs less than half as much as an all-metal coupling; a motor equipped with the Celoron half of the

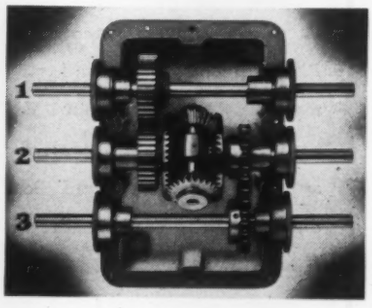


Motor equipped with this non-conducting coupling is completely insulated electrically from the part it drives

coupling is completely insulated from the unit which it drives. Celoron is not affected by heat or cold, oil, water, gasoline or common acids. Design of the coupling insures an equal distribution of load. There are no distinct points of wear as with a 2, 3, 4, 6 or 8-point coupling. The couplings are available in seven sizes to carry loads from ½ to 85 horsepower.

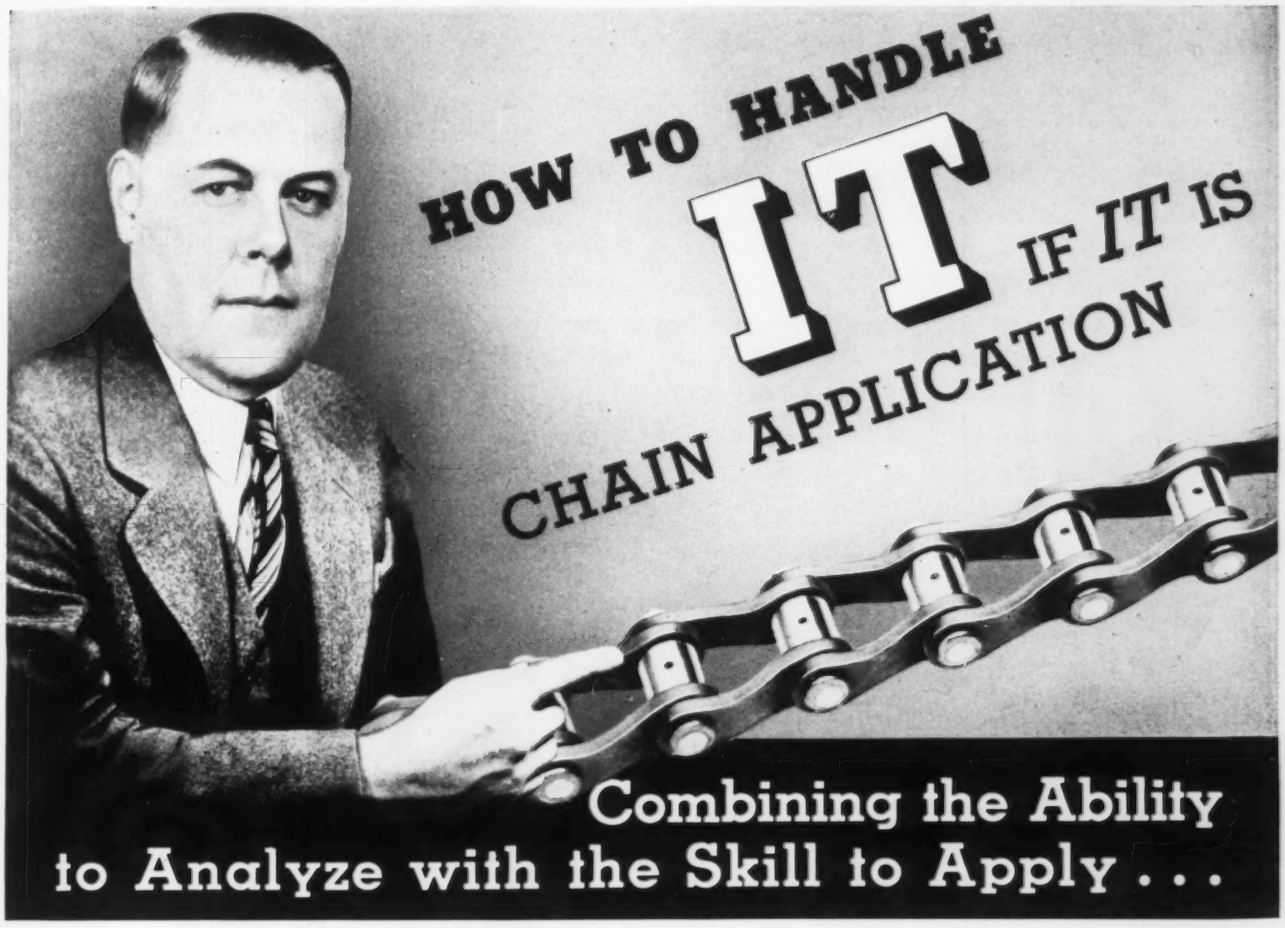
Differential, Accessory of Drive Line

SUPPLEMENTING its line of accessory equipment for use with the variable speed transmission, Reeves Pulley Co., Columbus, Ind., has developed a new differential. This unit, known as model MDB-3,



Differential is used for such requirements as synchronizing two or more machines or parts of a single machine

is similar in principle to the ordinary automotive differential. It is used for such requirements as synchronizing two or more machines or parts of a single machine, and maintenance of uniform peripheral winding or unwinding speeds. For automatic control service, shafts 1 and 3 are connected to the driven



● A heavy machinery manufacturer, when designing a final drive selected a roller chain with a 120,000 lb. ultimate strength. This seemed to him to be the proper chain to combine with the transmission.

On analysis of the problem, however, the Rex Engineers showed that a Rex Chain, having 180,000 lb. ultimate strength, made of special alloy steels, was necessary to handle the power load—and without over-chaining.

It was decided to make trial units on the latter basis and send them into the field. These have proved to be completely satisfactory. The Rex Engineers' recommendation became the standard specification.

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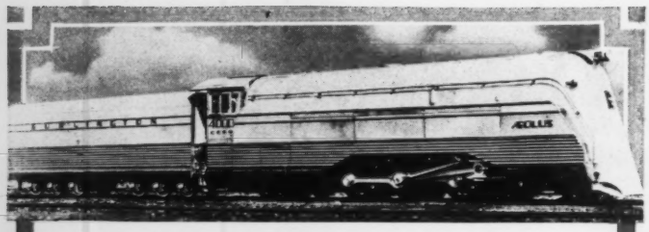

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Whip Old Conditions

The new locomotives offer a typical illustration of how old conditions are being met with far better results by McGILL *MULTIROL* Bearings—the original needle type.

In the valve gear, for instance, they reveal great improvements over bronze bushings which they replace. Constant alignment and permanent valve setting are assured. Bearing replacements and servicing are greatly reduced. Less oiling and greasing are necessary.

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Wide distribution of the load — or the great load capacity of McGILL *MULTIROL* Bearings in small radial space — makes them ideal for many applications. Especially under sustained or intermittent shock loads, they far outrun plain bearings and other anti-friction types with which they are often interchangeable dimensionally.

Stocked in standard sizes from ⅝ to 6-inch bore, single and double rows of rollers at low, volume production prices. Corrosion, heat resisting and other designs gladly engineered to specific conditions.

Send for Bulletin No. 37

McGILL MANUFACTURING CO.
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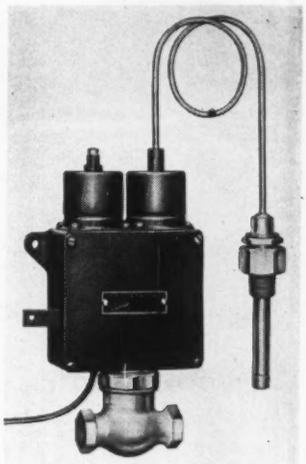
machine. Shaft 2 is connected to the speed changing screw of the transmission. When shafts 1 and 3 are driven in the same direction at the same speed shaft 2 stands still. If there is a variation in speed, it is transmitted to shaft 2 which speeds up or slows down the variable speed transmission until synchronous speed is restored. Dimensions of the differential are 8 inches wide, 11 inches long and 6⅝ inches high.

Controller Developed for Fuel Line

TO PROVIDE protection on diesel engines or similar machines against high water jacket temperature or low oil pressure the Sylphon safety control No. 530 has been developed by Fulton Sylphon Co., Knoxville, Tenn. Should water temperature go above or oil pressure go below the safe point, the control device immediately shuts off the fuel oil supply and the engine is stopped. Should the oil pressure control or water thermostat become inoperative because of injury, the engine will be automatically stopped. Mechanism of control is enclosed in cast brass box with integral mounting lugs. No stuffing boxes are used. A switch may be incorporated in the case to close electrical contacts when the control operates to ring a bell or other device.



Control device shuts off fuel supply if oil pressure drops or water jacket temperature becomes excessive

Viscous Type Air Cleaner Announced

TO PREVENT dust and grit from entering large gas and diesel engines or compressors and pumps, the Acoustic division of the Burgess Battery Co., 111 West Monroe street, Chicago, has developed the I-F series air cleaner. This unit, which is available in capacities up to 3150 cubic feet per minute at maximum velocity of 4000 feet per minute, may be used alone or in conjunction with the Burgess intake silencer. Filter is of the viscous-coated, impingement

BECAUSE we have over one million gears in stock we are able to *ship 95% of our stock orders within twenty-four hours.* Simplify your delivery problem — Specify Boston Stock Gears. Our General Catalog #51 contains complete specifications and list prices of all Boston Stock Gears. Write today for your copy.

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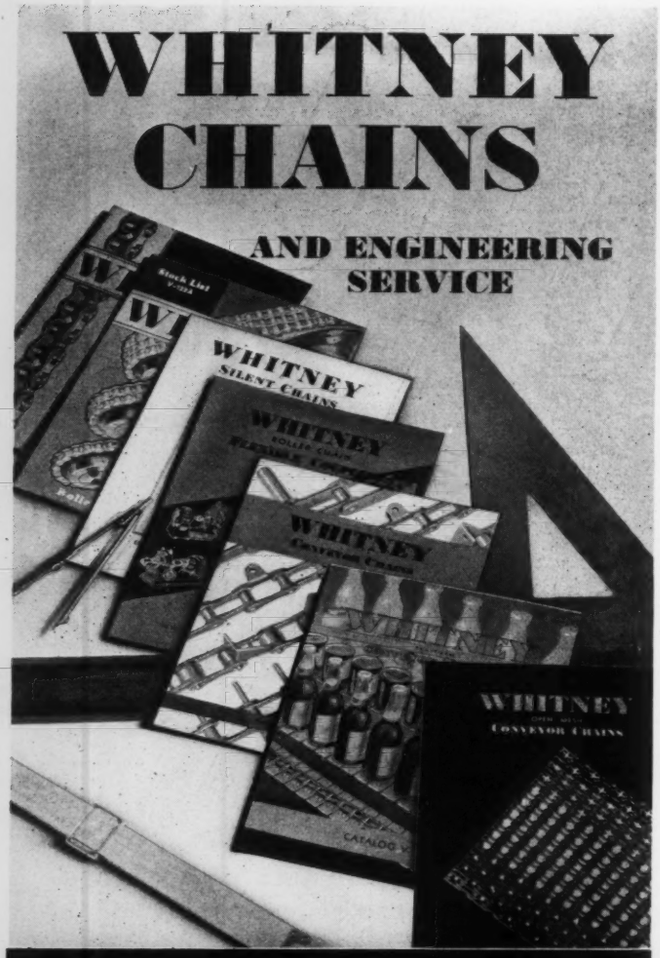

Whitney Chain Drives for Power Transmission and Conveying purposes offer an unusually wide latitude of design to the engineer and manufacturer of industrial machinery. They can be designed for

High average ultimate strength
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High, medium or low speed drives
Smoothness and quietness of operation
Short or long shaft centers
Flexibility for unusual space requirements
Reversibility of shaft operation
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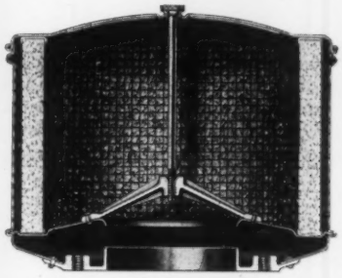
Patented no back bend feature
Patented automatic drive release

Let Whitney Chains and engineers cooperate on your problems. Write today for Catalog A. The Whitney Chain & Mfg. Co., Hartford, Conn.

WHITNEY CHAINS

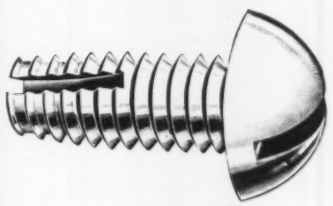
type and consists of a specially-wound copper gimp coated with sticky fluid, usually oil. Unit is rigidly constructed of heavy gage sheet steel. Parts cannot become loose and rattle. Resistance of the air cleaner to air flow is said to be negligible.



Resistance of air filter to air flow, which may be as high as 3150 cubic feet per minute, is negligible

Self-Threading Screw Announced

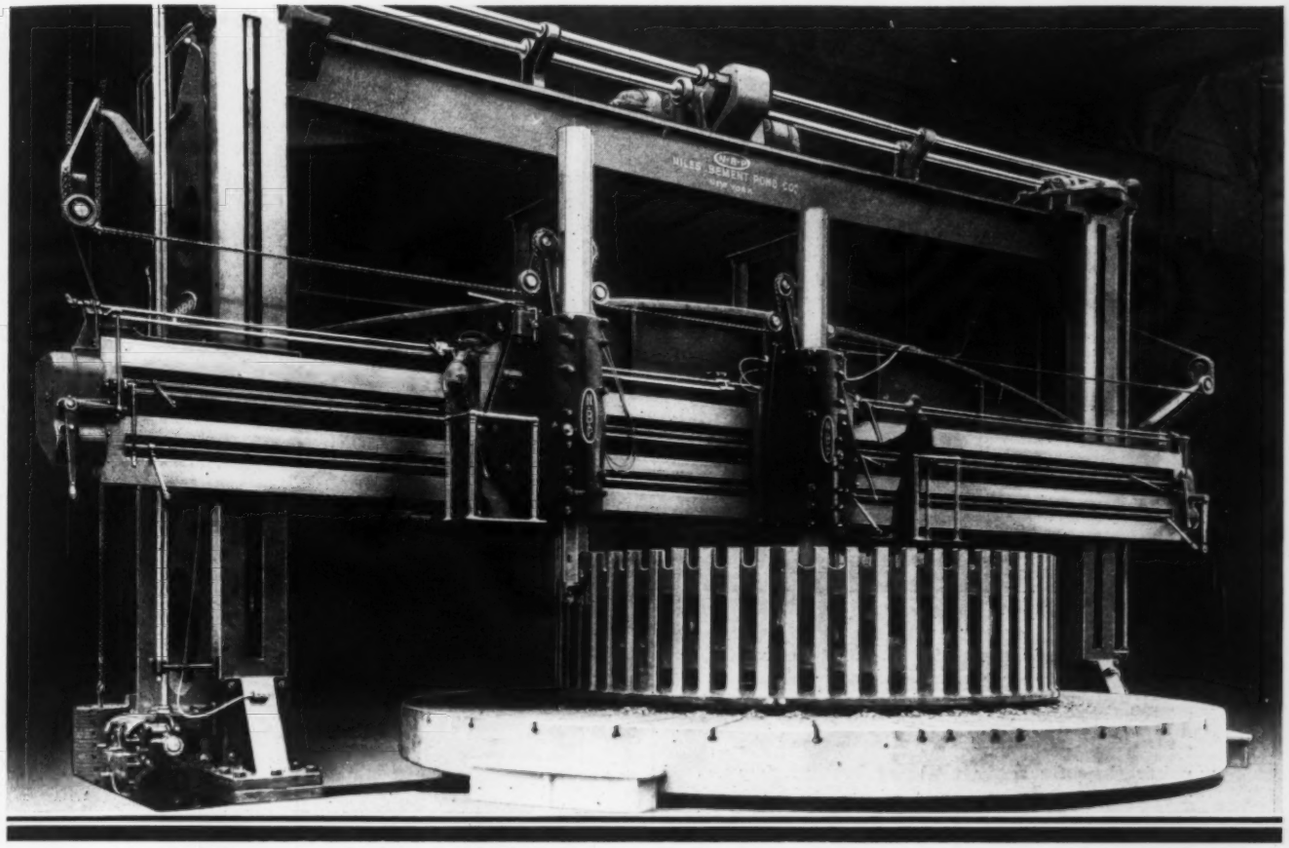
DESIGNED to cut its own thread in metals and plastics, a specially constructed screw is announced by Shakeproof Lock Washer Co., Chicago, Ill. A patented thread-cutting slot, plus a special hardening process, eliminates the separate tapping operation normally required in the use of standard machine screws. The yielding section of the screw springs inward as turning is started, thus permitting the serrated cutting edge to have free access to the material being threaded. Material removed as the screw cuts its own thread is directed into a slot, away from the cutting edge, eliminating the possibility of clogging. Should it ever be necessary to replace the screw, an ordinary machine screw of the same size will fit the threads.



Excess material from threading works up slot in screw and does not clog new threads

Many Uses for Hydraulic Motor

RECENT addition to the line of hydraulic equipment made by The Oilgear Co., Milwaukee, Wis., is a constant displacement fluid power motor, type C-811. The type C motors are of the constant torque type, maximum torque being available at all speeds. Large internal oil passages reduce hydraulic friction and the lubricating power of the fluid reduces mechanical friction to a minimum. On industrial drives the use of these motors in combination with Oilgear



for STRENGTH . . . RIGIDITY . . . QUIETNESS
Machine Tool Designers *specify* Gray Iron

WHERE precision, coupled with strength, rigidity and quietness are factors, gray iron is always specified by well informed machine tool designers.

Research and metallurgical developments have widened the application of this old engineering material.

Strength coupled with rigidity now offers new uses and lighter sections. That saves money in machine construction.

Quieter operation results from gray iron's exclusive vibration damping qualities, and besides, it has unequaled wear resisting qualities, resists corrosion and has a lower coefficient of expansion.

The sale of your equipment is made easier through better performance and the improved appearance which only the smooth, symmetrical lines of gray iron can offer.

A check of your present designs will show many places where you can profit from the 12 distinct advantages which gray iron offers.

Your foundryman will gladly share his experience in helping you obtain all of these benefits.

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RIGIDITY—That holds moving parts in free running alignment.

LOW EXPANSION COEFFICIENT prevents strains due to thermal changes.

RESISTANCE to heat, rust and corrosion.

MACHINES EASILY

LOW COST of duplicate parts.

INTRICATE SHAPES easily produced.

UNIFORMITY of duplicate parts.

GOOD BEARING PROPERTIES permit use in moving parts.

MINIMUM WASTE in machining.

IMPROVES APPEARANCE of your equipment with its smooth surfaces and symmetrical lines.

DAMPING EFFECT retards vibration and noise.

GRAY IRON FOUNDERS' SOCIETY, INC.

GRAY IRON CASTINGS

AIR « « OR HYDRAULIC

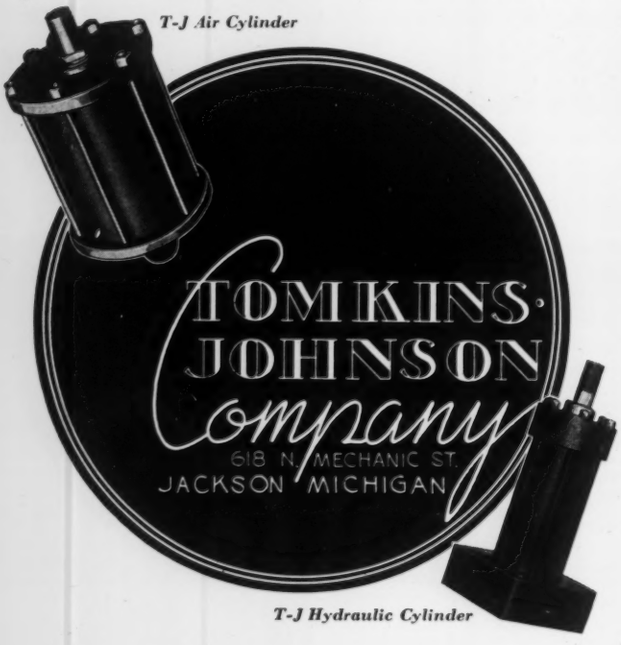
Keep abreast of the trend . . . let these two new catalogs assist you in solving your problems related to the use of Air or Hydraulic equipment. Every designer of machinery should have both publications for ready reference because they contain complete engineering data.

Request today Catalog No. H37 on hydraulic devices and No. 36 which covers air equipment.

Better T-J Hydraulic cylinders mean better performance. Or if Air Cylinders are preferred, T-J Air Equipment also meets the exacting requirements that modern industry is demanding of machinery embodying equipment of this type.

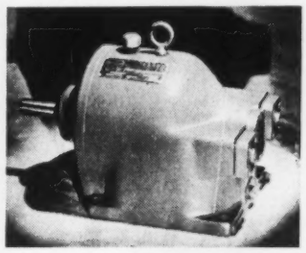
These catalogs will help you select the cylinders, valves, chucks, and special equipment which you require.

T-J Air Cylinder



T-J Hydraulic Cylinder

pumps is almost limitless. They have proven advantageous on paper mill drives, rewinder drives,

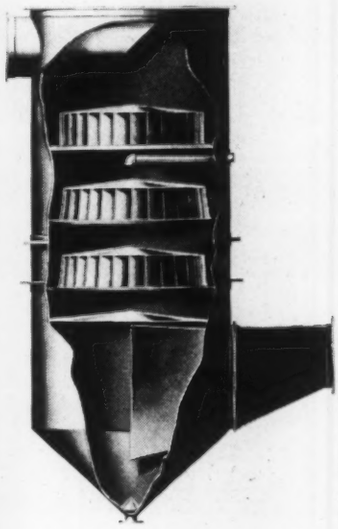


Hydraulic friction is reduced by large internal passages and fluid lubricates mechanical parts

printing press drives, rubber mill machinery, airplane catapults, etc. Motors are available in eight sizes.

Smaller Model Airwasher Available

AIR and gases are scrubbed and cleaned in a dust collector brought out by The Claude B. Schneible Co., 3951 Lawrence avenue, Chicago. Known as the Junior Multi-Wash dust collector, the new model has the same construction as the Senior model but gases are scrubbed only five instead of 13 times. Dust and



Air is drawn through water spray and over impingement plates which give extra cleaning action

fume-burdened air is drawn into bottom of the tower. Heavy particles are immediately deposited in the sludge cone. Air is drawn up through a turbulent spray of water, passing over two sets of impingement plates which scrub the air. An entrainment separator dewaters the air and it is discharged. The new model is designed expressly for shake-out devices, mullers, pulverizers, crushers, spray booths, molding stations and other equipment where clean air is required.

Motor Line Is Resiliently Mounted

RESILIENT mountings distinguish the new motor line just introduced by The Ohio Electric Mfg.

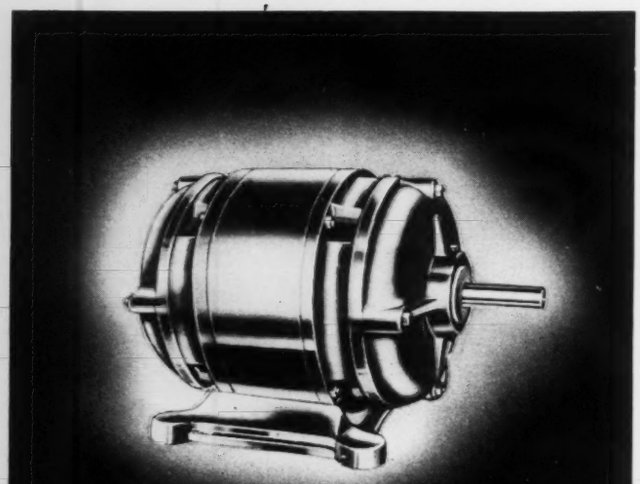
FROM THE PARKER-KALON LABORATORY

COMES A
higher standard
of quality
IN SOCKET SCREWS

It took over two years of intensive research and development work; and an investment of $250,000 in new laboratory equipment to produce Socket Screws good enough to uphold the Parker-Kalon reputation. When you get samples of the new Parker-Kalon Cold-forged Socket Screws, you will agree that the result fully justifies the expenditure of effort and money. Judged by any standard, these new Screws will measure up to your ideas of what good Socket Screws should be. Send for bulletin that gives full details and free samples of the types and sizes you use.

Parker-Kalon Corporation, 212 Varick Street, New York

PARKER-KALON
Cold-forged SOCKET SCREWS



VALLEY ELECTRIC MOTORS

—designers found them superior

With an eye toward that happy combination of economy, efficiency and lasting dependability, prominent designers, everywhere, are selecting Valley Electric Motors. They know that Valley Electric engineers are just as alert to the possibility of improvement as they were twenty years ago when Ball Bearings were incorporated in their designs.

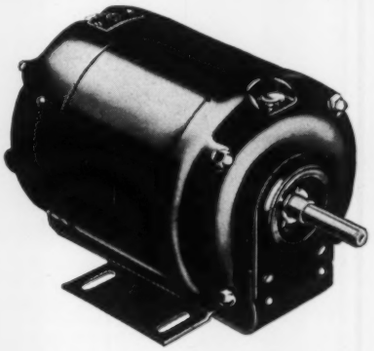
Features which have kept Valley Motors in the spotlight are:

1. **NO DEAD SPOTS:** The careful design of Valley Ball-Bearing Motors has eliminated occurrence of "dead spots."
2. **EFFICIENT AND VENTILATED WINDING:** The Valley Short Throw Winding, together with the form-wound coils are used, and result in high efficiency and low heating.
3. **40°C. MAXIMUM TEMPERATURE RISE:** Valley Motors are rated 40°C. maximum temperature rise under continuous full load conditions. In actual service, their performance is much better than this rating.
4. **SQUIRREL-CAGE WELDED ROTOR:** All Valley squirrel-cage rotors are welded by a special preheating process insuring a perfect union of bar and end-ring.
5. **BALL BEARINGS:** All Valley Motors are equipped with ball bearings especially selected for their suitability for motor applications. These bearings are protected by oil seals, and are absolutely dust-proof.

VALLEY ELECTRIC CORPORATION

4221 FOREST PARK BLVD. • ST., LOUIS

Co., 5914 Maurice avenue, Cleveland. Cushioning rings are of ample size to support motor and are not appreciably effected by heat or oil. If desired, the motor may be removed by loosening the end pieces,

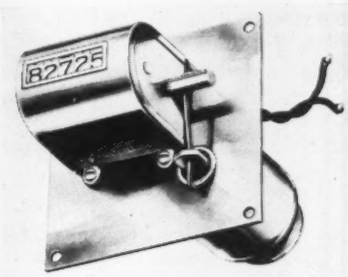


Motor may be removed by loosening end pieces without disturbing base

obviating the need for disturbing the base. Motors are available in sizes from ⅛ to 1/3 horsepower at speeds of 1150 and 1750 RPM.

Electric Counter Needs Little Space

A LINE of electrically operated counters, adapted to built-in applications on coin machines, production machinery and similar equipment has been announced by Production Instrument Co., 1325 South Wabash avenue, Chicago. The counter is unusually compact, measuring 1⅞ x 1½ x 1¾ inches, and is



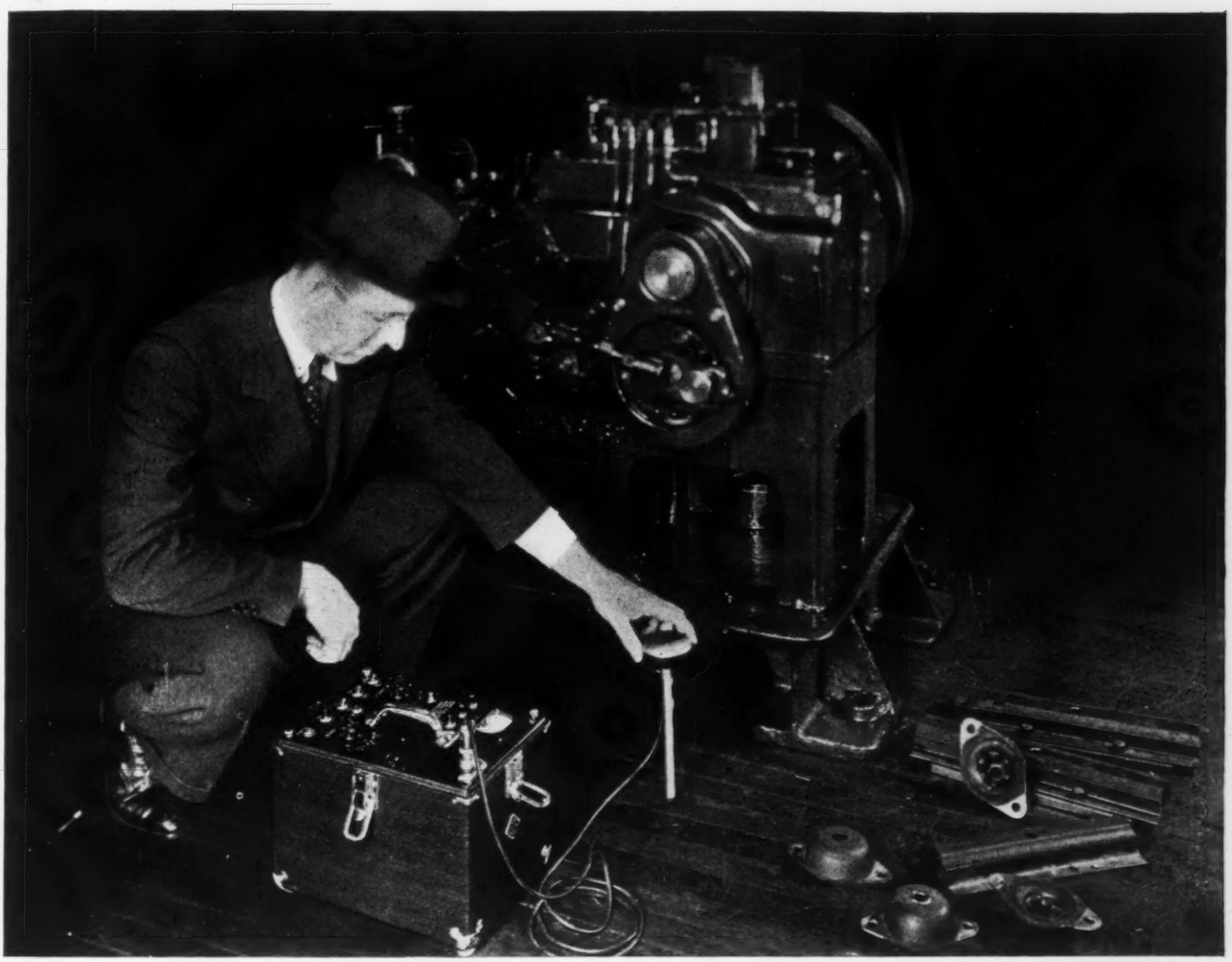
Counter is of the non-reset type. It is enclosed in steel case to prevent tampering and for protection

mounted on a plate 2⅞ inches square. It is equipped with large number wheels and black figures on a white background. Five number wheels give a capacity of 99,999 which is ample for all requirements in small counters. Steel case encloses the counter mechanism. The type SEC electric counter is a non-reset instrument.

Heat Controls Gas Valve

MAGNETIC valve suitable for every type of gas burning boiler, furnace, or stove, for domestic automatic heating or industrial uses has been placed on the market by Julien P. Friez & Sons, Inc., Balti-

(*Continued on Page* 82)



Photograph Courtesy New England Screw Company

Eliminating Vibration

VIBRATION generated in the machine illustrated was sufficient to crack the concrete floor. Oil seepage from the machine got into the cracks, permeated the entire floor and appeared as blotches on the ceiling below.

Measurements with the new General Radio Sound Level Meter (with a simple vibration pick-up) did three things:

Located the *source* of vibration in the machine screw header.
Made it possible to plot the amount and area of vibration in the floor around the machine.
Directly compared the effectiveness of the several vibration dampers used.

If vibration plays any part in the design or use of your machines this new General Radio instrument can be equally as effective in locating its source and eliminating its effect.

The G-R Sound Level Meter at the same time is always ready to measure the intensity of noise over a range of plus 24 to plus 130 db. It is extremely simple to operate, self-contained, portable, light-weight and calibrated to read directly in db. Its calibration agrees with the standards set up by the various engineering societies and standardization bodies.

Type 759-A Sound Level Meter....$195.00. (Vibration pick-up extra, depending upon type required).

Let General Radio engineers tell you how this instrument can be of great help to you. Let us know what your vibration or noise problem is.

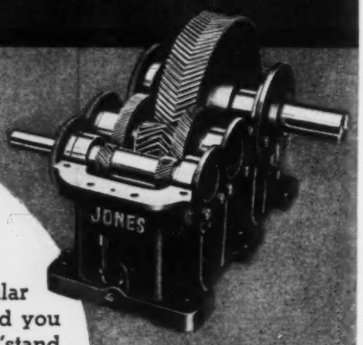
● ***Write for Bulletin 189 for complete information.***

GENERAL RADIO COMPANY

Cambridge **Massachusetts**

IN THE SERVICE OF INDUSTRY
JONES

SPEED REDUCERS



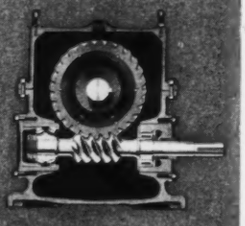
WHEN you want a speed reducer you want the type that will best handle your particular drive problem . . . and you want a reducer that will "stand the gaff." Jones reducers measure up to both standards.

It makes no difference whether you require herringbone, spur or worm gear reducers, the Jones organization can give you just what you need in any ratio and capacity . . . and over the years Jones reducers have shown the ability to "take it" under the most severe operating conditions.

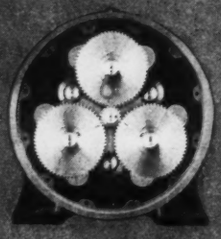
Jones offers your kind of speed reducers to solve your kind of drive problems.

W. A. JONES FOUNDRY & MACHINE CO.
4413 Roosevelt Road, Chicago, Ill.

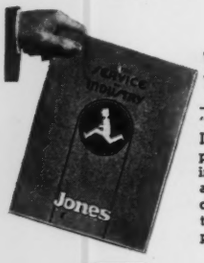
Herringbone Reducers
Ratios 1¼ to 1 up to 300 to 1 in capacities from 1 to 400 H.P.



Worm Gear Reducers
Ratios 4 to 1 up to 90 to 1 in capacities from ¼ to 100 H.P.



Spur Gear Reducers
Ratios 5⅓ to 1 up to 200 to 1 in capacities from ½ to 75 H.P.



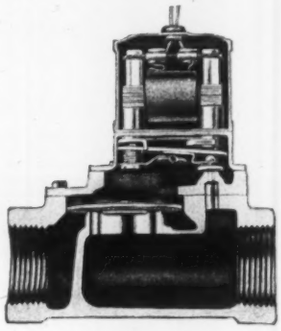
WRITE FOR YOUR COPY
—of the bulletin "In the Service of Industry" which presents interesting information about speed reducers and other transmission products.

Since 1890
Jones

HERRINGBONE — WORM — SPUR — GEAR SPEED REDUCERS
CUT AND MOLDED TOOTH GEARS — V-BELT SHEAVES
ANTI-FRICTION PILLOW BLOCKS — PULLEYS
FRICTION CLUTCHES AND TRANSMISSION APPLIANCES

(*Continued from Page* 78)

more, Md. Requiring no attention, it operates with entire safety on low voltage current without hum or noise. When the thermostat in the valve calls for heat,



Main valve body is bronze and floating disk is aluminum with leather stretched over it

an electric circuit is completed which lifts a bleeder valve; incoming gas pressure then lifts the floating disk, thereby fully opening the main valve. Main valve body is of bronze. Floating disk is of aluminum over which is stretched kid leather. Valves are available from ¼ to 1¼ inches pipe size.

Centrifugal Pump Takes Little Space

OCCUPYING little space, a compact, vertical, submerged type centrifugal pump, designed for the circulation of coolant cutting compounds or similar liquids containing abrasives in suspension has been developed by Goulds Pumps, Inc., Seneca Falls, N. Y. Impeller is mounted directly on extended motor shaft of large diameter, eliminating need for lower pump

Pump casing is cast integral with motor support, insuring correct alignment of motor and pump

bearing. Pump casing is cast integral with motor support, at top of which motor is held in position with male and female lock to insure permanent alignment. Impeller is of open, double-suction type, hydraulically balanced to eliminate end thrust. The

FRICTION

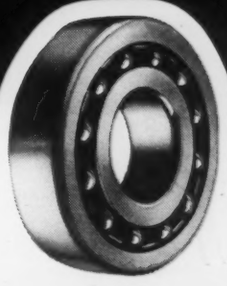
NO LONGER RETARDS PRODUCTION IN PLANTS THAT ARE SKF-EQUIPPED

Old time plant supers remember the days when plain bearings caused executives to run hot under the collar . . . when production slipped because of frequent stops for repairs, and costs sky-rocketed because old-fashioned bearings in line shafting and machine equipment simply couldn't take it.

Now with SKF Bearings dominating the industrial picture those days are gone forever. SKF produces an anti-friction bearing for every bearing purpose and always puts it in the right place. Among the outstanding SKF achievements are SKF Spherical Journal Bearings that have answered the railroad's hot box problem, and SKF Self-Aligning Ball Bearings that are in use today throughout the world.

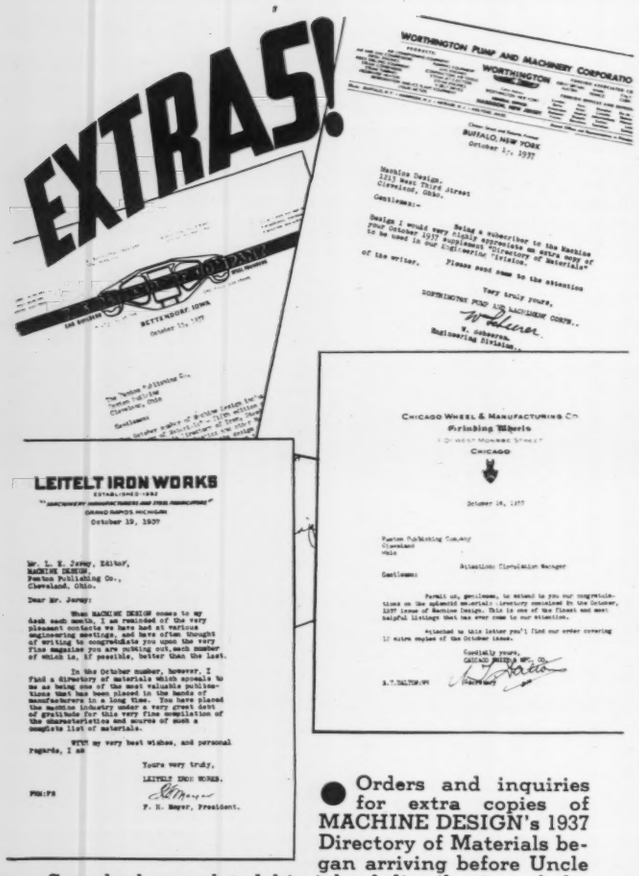
When you have a bearing problem put it up to SKF...largest manufacturer of industrial bearings in the world. SKF Industries, Inc., Front St. and Erie Ave., Phila., Pa.

3938



SKF

BALL AND ROLLER BEARINGS



● Orders and inquiries for extra copies of MACHINE DESIGN's 1937 Directory of Materials began arriving before Uncle Sam had completed his job of distribution of the October issue.

Anticipating the demand, we prepared what we hoped would be an ample supply of the Directory. Present indications are that we figured too low. Consequently we urge that all companies, engineering departments or individuals desiring additional copies send their orders without delay to avoid disappointment.

The 1937 (Fifth Edition) Directory of Materials contains upwards of 1100 material listings in 48 pages of descriptive and analytical data on iron, steel and nonferrous alloys, plastics and other nonmetallic materials, as used in the design of machinery of all types and sizes. In addition to the alphabetical listing of tradenamed materials and the comprehensive selection guide to principal properties, the new Directory contains a cross-reference listing of materials under the names of producing companies.

A Chicago manufacturer in ordering twelve extra copies wrote of the 1937 Materials Directory: "one of the finest and most helpful listings that has ever come to our attention."—Perhaps your own engineering personnel will find individual copies profitable.

A special schedule of rates in quantities has been established. All orders will be filled in order of their receipt and copies will be sent postpaid.

Number of Copies	Price Per Copy	Total
1	25c	$ .25
10	20c	2.00
25	18c	4.50
50	16c	8.00
100	15c	15.00

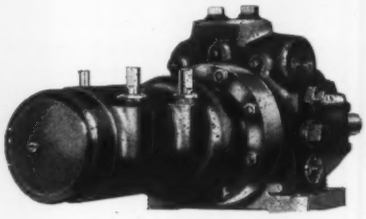
MACHINE DESIGN

Penton Building ● Cleveland, Ohio

pump has a capacity up to 30 gallons per minute and produces a head of 19 feet.

Control Valves in Pump Housing

CONTROL valves are built into the pump housing in a new line of hydraulic pumps recently announced by Sundstrand Machine Tool Co., Rockford, Ill. The units are extremely compact and are made in two sizes, the larger being model 10PWX and the

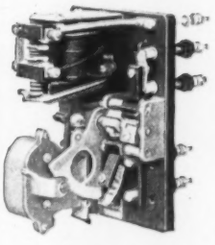


Smooth feeds are possible because of multiple piston pump design

smaller, 5PWX. New feature in the 10PWX unit is a variable displacement piston pump which can be furnished with three different feed rates. In addition the unit embodies a constant volume pump which provides rapid traverse. Both pumps are driven by a single shaft.

Timer Relay Is Offered

OF PARTICULAR importance to machinery manufacturers is a new definite-time relay employing a clutch-type time delay interlock developed by General Electric Co., Schenectady, N. Y., to provide a reliable means of timing a sequence of operations in



Relay of this type is useful for starting several motors at intervals or starting different parts of machines separately

a control system. Available in either alternating or direct current forms with two, four or six circuits, the CR2820-1729 is extremely flexible and adapted for use wherever it is desired to perform several operations in sequence.

Engineering Department Equipment

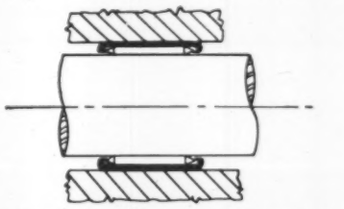
Hanger Designed for Blueprints

MADE of duraluminum and provided with a title strip which may be easily removed for lettering, a new blueprint binder hanger has been placed on the market by Wade Instrument Co., 1663-M,

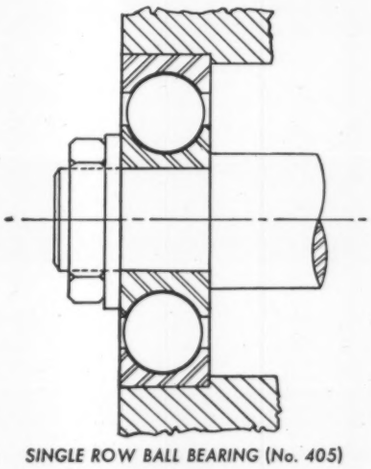
Compare The Value of the
Torrington Needle Bearing

A COMPARISON of the Torrington Needle Bearing with a ball bearing and a bronze bushing of equivalent load rating clearly illustrates the advantages and value of this new Needle Bearing for many types of applications. In the accompanying table a detailed comparison is given of a Torrington B-1616 Needle Bearing with a 405 single row ball bearing and a bronze bushing of three square inch bearing surface. The speed curves for these three bearings are almost identical and therefore these standard sizes permit a fair basis for comparison.

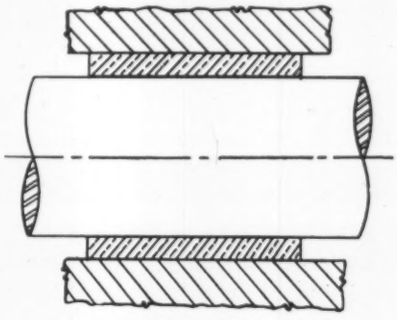
	TORRINGTON NEEDLE BEARING No. B-1616	BALL BEARING No. 405	BRONZE BUSHING 1½" x 1⅞" x 2"
Radial Load Capacity....	Same for all, with hard shaft required for Torrington Needle Bearing.	Same for all.	Same for all.
Thrust Capacity.....	None.	High.	None.
Space Required.....	1¼" O.D. x 1" I.D. x 1" Axially.	3-15/100" O.D. x 9-8/100" I.D. x 8-3/100" Axially.	1⅞" Radially x 2" Axially with 1½" shaft required to give needed bushing area.
Starting Friction Coefficient.	Slightly higher than ball bearing.	Slightly lower than Needle Bearing.	Considerably higher than either ball or Needle Bearing.
Running Friction Coefficient.	Slightly higher than ball bearing.	Slightly lower than Needle Bearing.	Same as Needle Bearing when extreme care is used in fit and in lubrication.
Installation.....	Needs accurate housing bore and shaft, but easy to install.	Same as Needle Bearing.	Requires very careful fitting to obtain good results.
Lubrication.....	Needs only ordinary care.	Same as Needle Bearing.	Continuous pressure lubrication to stand loads other 2 types will carry.
Price Ratios in 500 Lots..	Approximately one-fifth cost of ball bearing: one-third more than cost of bushing.	Approximately five times cost of Needle Bearing.	Approximately three-fourths cost of Needle Bearing: one-eighth cost of ball bearing



TORRINGTON (B-1616) NEEDLE BEARING



SINGLE ROW BALL BEARING (No. 405)



BRONZE BUSHING—3 sq. in. surface area

These three bearings of the same radial load capacity vary widely in size and shape. All are shown in the same scale—a 40% reduction of actual size.

From this table and from the three illustrations at the left, which are shown in proportionate size, it is readily apparent that the Torrington Needle Bearing is the ideal bearing for use in many applications—particularly where small size, ease of installation, efficient lubrication, and low material cost are important factors in developing the design and determining type of bearing to be employed.

Manufacturers interested in the advantages and economies of the new Torrington Needle Bearing are invited to work directly with the Torrington Engineering Department in developing designs and laying out applications. A copy of the Torrington Needle Bearing Catalog giving more information will be supplied on request. Write for *Catalog No. 9.*

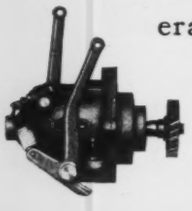
The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.
Branch Offices in all Principal Cities

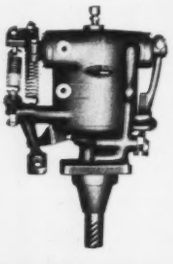
TORRINGTON
NEEDLE BEARING

POWER CONTROL perfected by PIERCE

•

Through twenty-five years of engineering experience and governor research, the Pierce Governor Company has developed a line of governors that completely covers every industrial application. • *The Pierce Engineering Staff* co-operates with engine designers and builders, and all manufacturers of engine-driven equipment in the development of new or unusual types of governors to meet today's needs. • Correct in principle, painstakingly built to a minimum tolerance, Pierce Governors are recognized as standard the world over. • Put your governor problems up to Pierce—write for new complete catalog just off the press.





PIERCE GOVERNOR COMPANY
109 OHIO AVE., ANDERSON, INDIANA

PIERCE GOVERNORS
STANDARD SINCE 1913

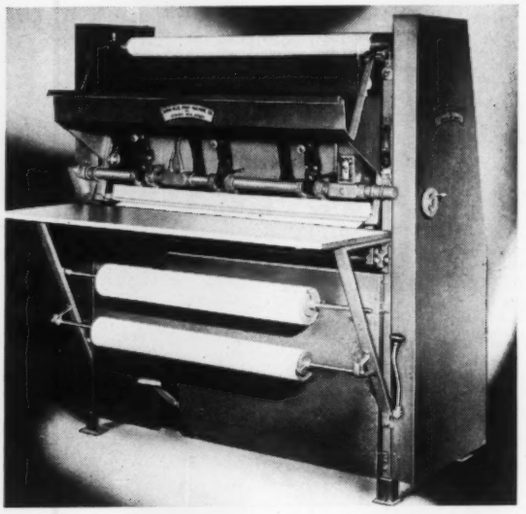
E. 118th street, Cleveland. The center hook may be turned down so that prints can be rolled or turned back. Three telescoping binder posts may be tightened

Three telescoping binder posts hold prints in hanger and may be tightened with a coin

with a coin. There are no sharp corners, projections, or wingnuts to mar prints. The device will bind about 75 blueprints.

All-Steel Blueprinter Announced

HIGH speed blueprinting machine of all-steel framework and arc welded construction has been placed on the market by The Shaw Blue Print Machine Co., Inc., 9-11 Campbell street, Newark, N .J. Known as the model M printer it reproduces blueprints or black and white prints. Three arc lamps



Variable speed drive enables output to be varied according to type of printing operation

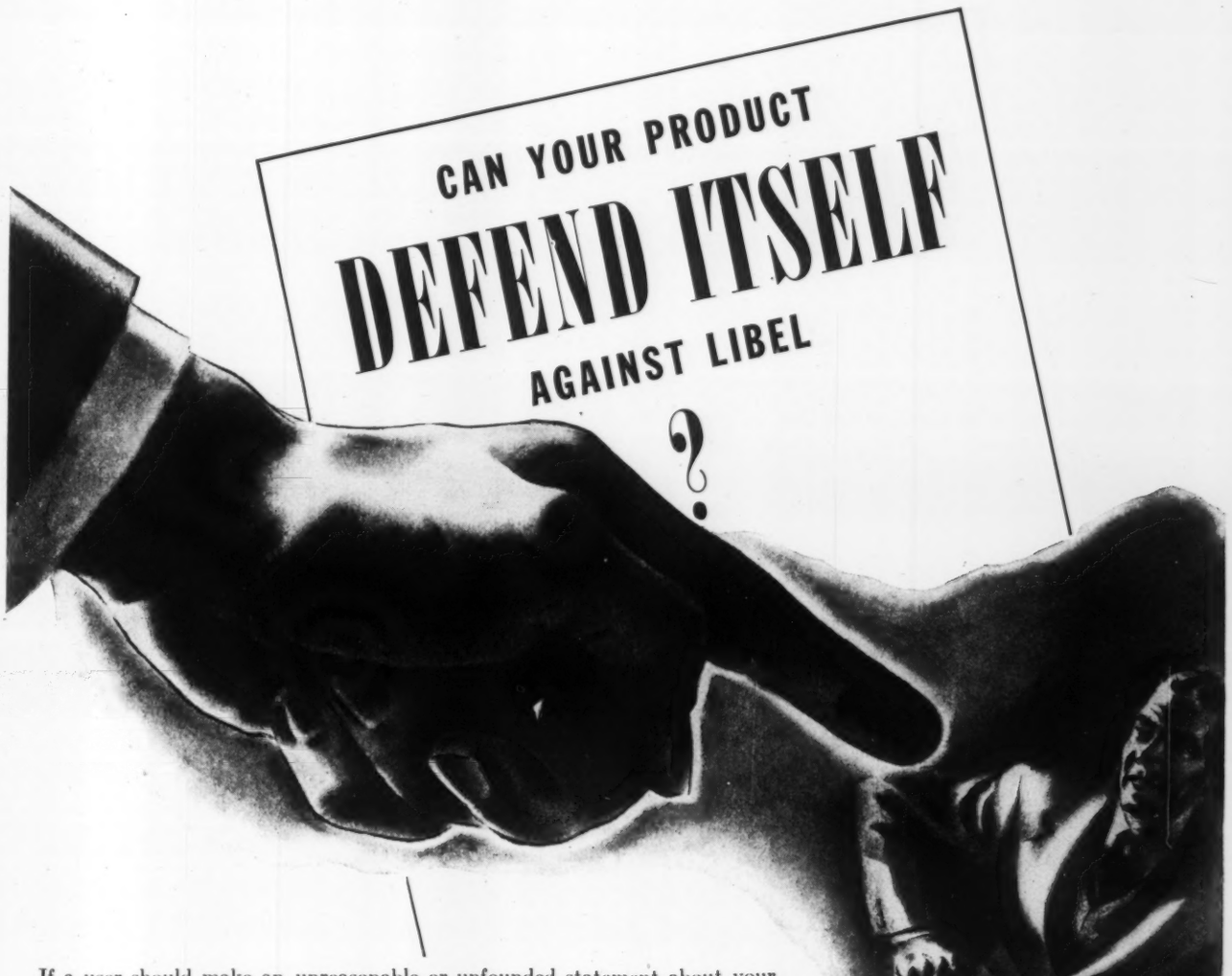
using ½ x 9-inch carbons provide strong light for the blueprinting operation. Equipment is powered with a ¼-horsepower constant speed motor and speed variation is obtained by a Reeves variable speed drive. Standard equipment is a 42-inch machine but a 54-inch model is available.

CAN YOUR PRODUCT

DEFEND ITSELF

AGAINST LIBEL

?



If a user should make an unreasonable or unfounded statement about your product, could he get away with it? There's nothing to stop him . . . if your product can't defend itself, *can't give its own side of the case.*

Many a product has cleared its name . . . many a difficult situation has been straightened out . . . by the straightforward, *uncontradictable* testimony of a built-in Veeder-Root counting device. For there, in plain figures which can't lie, is the whole truth and nothing but. Proof positive of honest service, of good faith under the sales contract.

Thousands of Veeder-Root counters are hard at work today, compiling evidence on all sorts of products . . . business machines, elevators, trucks, farm implements, pumps, compressors, machine tools, and many others. And they compile it in any form . . . operations, starts, stops, revolutions, pieces, trips, mileages, volumes, speeds, lengths, light-flashes—*or shadows.* Fit *your* product to defend itself . . . it's not only sound protection but potent sales promotion. Have a Veeder-Root engineer survey your product with a creative eye, to determine places and uses for a built-in counter. No obligation. Write.

Counters for Every Purpose

VEEDER-ROOT INC. HARTFORD, CONNECTICUT

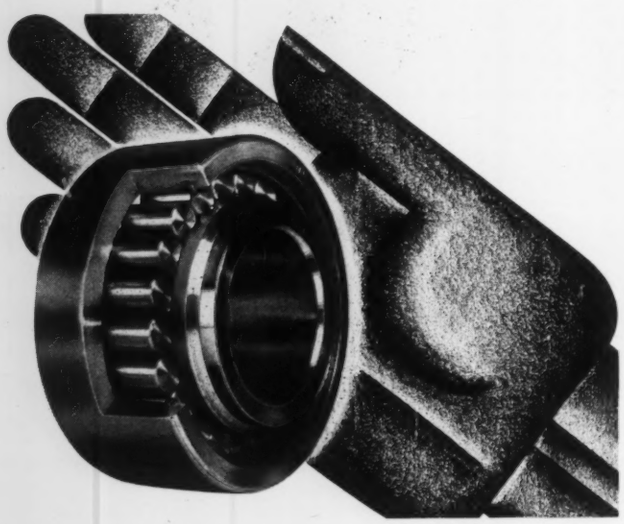
OFFICES IN BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT GREENVILLE, S. C. LOS ANGELES NEW YORK PHILADELPHIA PITTSBURGH ST. LOUIS SAN FRANCISCO MONTREAL, CANADA BUENOS AIRES MEXICO CITY LONDON PARIS TOKIO SHANGHAI MELBOURNE

BUILD THE PUMP *Into* YOUR MACHINE

For compact, economical pump installations, Tuthill supplies "stripped" models for incorporating directly into the design of your machine. Pumps for coolant, lubricating and hydraulic service are available. Capacities to 50 g.p.m. Series "S" provides pumps without the supporting bracket. Series "SA" includes only the rotor, idler and cover assembly. Write for complete details.

TUTHILL PUMP COMPANY
941 EAST NINETY-FIFTH ST., CHICAGO, ILLINOIS

For information on pump illustrated above, send for Tuthill "Stripped" Pump Bulletin, Series S and SA.



STOP TIME AND POWER LOSSES

The only satisfactory way to stop losses due to bearing trouble is to specify the right bearing for the job. ROLLWAY Bearings are expertly engineered from your specifications to give the utmost freedom from friction.

Such individualized application of ROLLWAY's long experience is possible *only* because ROLLWAY specializes exclusively in straight radial and thrust roller bearings. We suggest that you can best judge our engineering and production facilities by putting them to work for you. An outstanding characteristic of ROLLWAY service is *on-time* delivery regardless of the complexity of the problem. Write for a ROLLWAY analysis of your bearing problem.

ROLLWAY BEARING CO. INC., SYRACUSE, N. Y.

MEETINGS *and* EXPOSITIONS

Nov. 10-12—

International Acetylene association. Thirty-eighth annual convention to be held at Hotel Tutwiler, Birmingham, Ala. H. F. Reinhard, Union Carbide Co., 205 East Forty-second street, New York, is secretary.

Nov. 15-19—

National Association of Bottling Machinery Manufacturers. Annual meeting and exhibit to be held at Roosevelt hotel, New Orleans. Louis B. Montfort, 218 Munsey building, Washington, D. C., is secretary.

Nov. 16-19—

National Association of Refrigerating Engineers. Annual meeting and exhibit to be held at William Penn hotel, Pittsburgh. Emerson Brandt, 228 North LaSalle street, Chicago, is secretary.

Nov. 17-19—

American Institute of Chemical Engineers. Annual meeting to be held in St. Louis. Stephen L. Tyler, 29 West Thirty-ninth street, New York, is secretary.

Nov. 29-Dec. 2—

American Society of Agricultural Engineers. Winter meeting to be held at Stevens Hotel, Chicago. Raymond Olney, St. Joseph, Mich., is secretary.

Dec. 3-4—

Motor and Equipment Wholesalers association. Annual meeting and exhibit to be held at Stevens hotel, Chicago. B. W. Ruark, 400 West Madison street, Chicago, is general manager.

Dec. 7-8—

Mississippi Valley Farm Equipment association. Annual meeting to be held at DeSoto hotel, St. Louis. W. V. Jeans, 5866 Maple avenue, St. Louis, is secretary.

Dec. 6-10—

American Society of Mechanical Engineers. Annual meeting and technical sessions to be held in New York. C. E. Davies, 29 West Thirty-ninth street, New York, is secretary.

Century

FRACTIONAL H. P. MOTORS
For Every Purpose

There is a Century Fractional Horse Power Motor of the type best suited to drive every kind of appliance and tool.

SINGLE PHASE
POLYPHASE · · DIRECT CURRENT
for
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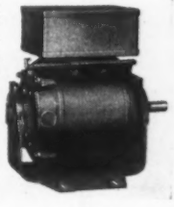

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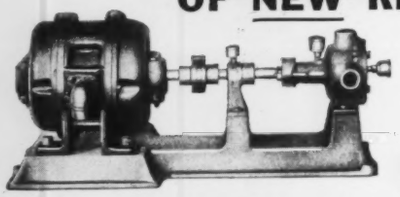
1806 Pine Street · · · · St. Louis, Mo.
Offices and Stock Points in All Principal Cities

Century MOTORS

UP TO 600 HORSE POWER

THOUSANDS

OF NEW REASONS



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VIKING PUMPS

Throughout the field of Machinery Designing Viking Rotary Pumps are used successfully and economically. They are the thousands of silent reasons why you should completely equip YOUR plant with Viking. Built for the job they are expected to do, Viking Rotary Pumps guarantee you greater performance, plus, the profitable advantage of lower upkeep cost. Write today for complete bulletins.

VIKING PUMP CO.

CEDAR FALLS, IOWA

PULLMORE CLUTCHES

Used in Roustabout Cranes

In reply to our inquiry about their application of Pullmore Clutches, Hughes-Keenan write "We are using two of your Double-Type Pullmore Clutches on our Model MC-2 Roustabout Cranes. The right-hand clutch is used for operating the hoist line and raising and lowering the boom, the left-hand clutch is for swinging the boom to right or left. We are using Pullmore Clutches because they are very compact, give long service without adjustments, and we have found them very reliable in service."

New Booklet—FREE

New Booklet now available shows 26 typical applications of Pullmore Clutches; gives complete data on sizes, dimensions and capacities; also brief information on our O-C Toggle Type and Spring-Loaded Clutches. Write for a copy today.

ROCKFORD DRILLING MACHINE DIVISION

Borg-Warner Corporation, 304 Catherine Street, Rockford, Illinois

Sold by MORSE CHAIN CO., Ithaca, N. Y. With offices in principal cities

Cars for '38

(*Continued from Page* 34)

gap and with the coil capacity such that satisfactory performance will be maintained with a gap of .040-inch.

The two distributors seen in *Fig.* 8 on the Cadillac V-16 engine might indicate that they were duplicate units, which construction has been used in the past where two banks of cylinders are involved. In the Cadillac 16, the left-hand distributor has two breaker arms, the fixed one making and breaking the primary current for the left-hand coil and cylinder bank. The second arm is adjustable and acts as a breaker for the right coil and cylinder bank. In this way its advance mechanism completely controls the spark advance for both banks and prevents any possibility of backlash in the control linkage causing one bank's timing to drop behind the other. The left distributor rotor furnishes high tension current to the left block only.

Grilles Built Up of Cast Parts

There is an increase in the use of die-cast radiator grilles. The grille bars are usually less in number and more widely spaced which facilitates the manufacture of the grille as well as to cause less disturbance of the natural air flow to the radiator core. Rounded front contours have been replaced by straight vertical designs. A number of grilles are built up from individual bars, stacked one above the other, which materially reduce die costs. Others provide a two-piece construction so that in case of damage to one side it can be removed and replaced with considerably less expense than were it necessary to replace the entire grille. This construction is used by Chevrolet; the grille is to all appearance a one-piece die-cast unit, so excellent is the workmanship on the individual stampings.

Plastics are not new in automobiles but today practically every car uses this material for the steering wheel, control buttons, gear-shift lever ball,, cowl ventilator knob, window regulator knobs and for interior decoration. They are now coming into their own for instrument panels, being used by Graham, Cadillac, LaSalle and Hupmobile in the form of a centrally-raised panel on the instrument board; in some instances the various instruments are combined with the panel together with the various control buttons. The Oldsmobile panel is distinctly novel, as shown in *Fig.* 6. The instrument unit is made of Bakelite and is located directly ahead of the operator. A large circular speedometer dial protrudes at the center with its integral visor. The water temperature and ammeter indicators are at the left and the oil pressure and gasoline indicators at the right. Below the instru-

157,680,000 Contacts

AND STILL GOING STRONG!

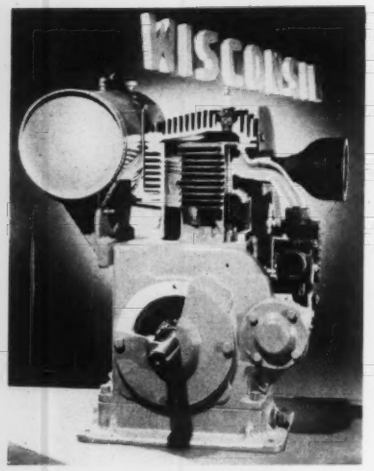
"For over five years," said this manufacturer, "we have used General Electric KON-NEC-TORS. We have had such good service from them that I feel they have been giving our displays a record for dependability. We like to send displays out as nearly fool-proof as possible.

"General Electric KON-NEC-TORS have proved themselves to be unaffected by millions upon millions of makes and breaks of current. One unit we used for demonstration has been running steadily twenty-four hours a day without interruption for five years. It completes a cycle every second, and a total of 157,680,000 contacts and breaks over that period. It's still going strong!"

Service without failure is one of the outstanding features of KON-NEC-TORS. They are fool-proof and wear-proof . . . require no maintenance . . . are easily adapted to use where the utmost reliability, quiet operation or long life are requisites. For full details address the General Electric Vapor Lamp Company, 825 Adams Street, Hoboken, N. J.

GENERAL ELECTRIC
VAPOR LAMP COMPANY

839-K



A reproduction of
Model AD—3H.P.
Air-cooled engine.

A complete line
1 to 16 H. P.

THE ALL-WEATHER ENGINE
MUST BE AIR-COOLED

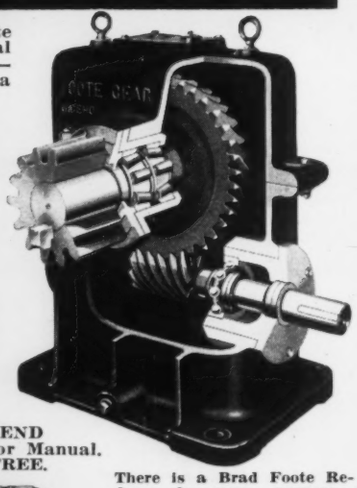
Your best insurance against trouble and expense no matter what weather conditions may be —

HEAVY DUTY AIR COOLED ENGINES by WISCONSIN MOTOR CORPORATION

WISCONSIN
MOTOR CORP., MILWAUKEE, WIS.

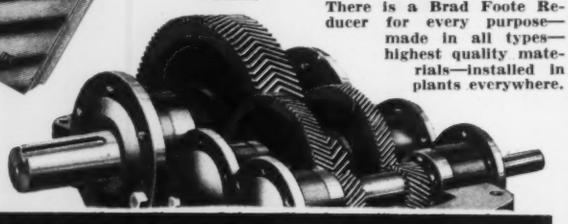
Brad Foote SPEED REDUCERS

The new Brad Foote Speed Reducer manual contains valuable data—ratings may be had at a glance—new information on power transmission.



SEND
for Manual.
FREE.

There is a Brad Foote Reducer for every purpose—made in all types—highest quality materials—installed in plants everywhere.



FOOTE GEAR WORKS INC.
1301 S. CICERO AVE., CICERO, ILL.

ments the panel is swept back to a curved contour.

Two distinct body designs have made their appearance. The Graham shown in *Fig.* 1, right, is provided with fenders which lean forward and the same line is used in the radiator grille which rises to meet the rounded hood top. The wheel opening of the front fender hides the upper part of the tires and does not follow the stereotyped radius for the wheel opening. Headlamp lenses conform entirely to the fender contour and thus eliminate the customary excrescences.

Body Dimensions Increased

The Lincoln Zephyr which pioneered the alligator type of hood top, has now extended the forward end downward in the form of a nose which merges into the V front. At the base of the V at each side, located well down in the aprons, are rectangular openings with horizontal grilles which extend to the fender crowns, shown in *Fig.* 1, left.

Body dimensions have been increased generally in length, width and height due to increase in wheelbase, shifting forward of the power plant, moving the instrument board ahead and widening of the frame and body. The safety seat with the soft rounded upper edge to protect the rear passengers should they be accidently thrust forward which was introduced on the 1937 Chrysler-built cars, is now being used by all General Motors cars and the Lincoln Zephyr.

Nash Is Air Conditioned

The Nash "air conditioning unit" contains an air filter, a motor-driven fan and a hot water heating element. The unit is mounted under the cowl and is connected with the cowl ventilator opening by means of a stack in which the greater part of the air moisture is removed. When the system is in operation, air is forced into the cowl ventliator at a rate depending upon the car speed yet it can be controlled through the adjustment of the ventilator. The fan maintains a flow of clean, warm air into the car and serves to keep the air pressure constant when travelling at different speeds. Ordinarily a vacuum is induced within the body. The built-up pressure also prevents the entrance of cold air from outside. The rate of air intake at 30 miles per hour is 300 cubic feet per minute.

In looking over the new improvements, those pertaining to the transmission and its control are far-reaching. At last the conventional gearbox has been challenged. Engine improvements share honors with the new suspension offerings. In addition to these, almost every manufacturer has incorporated changes of considerable interest. Styling advances indicate new types of front-end treatment and exteriors void of all gadgets that might mar smoothness and sweeping surfaces. The automobile manufacturers have again pointed the way to new heights in design.

INADEQUATE PROTECTION *is an* *INSIDIOUS THIEF!*

INVENTIONS AND THEIR PROTECTION

by George V. Woodling

I—Superinvention

II—Every Patent Action Needs Individual Study

III—Patent Disclosures

IV—Patent Rights Between Employer and Employe

V—Important Considerations Prior to Patent Application

VI—Requirements of Patentability (1) General Provision

VII—Requirements of Patentability (2) Statutory Classes

VIII—Requirements of Patentability (3) Utility and Dignity of Invention

IX—Requirements of Patentability (4) Statutory Newness For Novelty

X—Interferences

XI—The Patent Application

XII—Value of Patent Depends Upon Efficient Claims

XIII—Patent Infringement May be Avoided by Careful Design

XIV—Sales Value of Appearance Can Be Protected

XV—Assignments and Licenses

XVI—Use of Trademarks

Almost every designer and engineer knows of developments and ideas that failed to make their conceivers a profit, because adequate steps were not taken for their protection.

Realizing the urgent need for a better understanding of patents and patent law, MACHINE DESIGN has published a number of articles on the subject.

Now, a thorough discussion of patents and patent law is being published in book form, in order that every designer, engineer and inventor may have the salient facts concerning proper protection of ideas, in nonlegal terminology, between the covers of a single volume.

"INVENTIONS AND THEIR PROTECTION"

By George V. Woodling, B.S.E.E., L.L.B., E.E.

(6 x 9 in., cloth bound, over 300 pages, 16 chapters, 47 illustrations, $5.00, postpaid.)

Mr. Woodling, an outstanding patent attorney and himself an inventor of several developments in air conditioning and automotive fields, is fully qualified to be the author of this new book. He is the author of several articles that have appeared in MACHINE DESIGN, some of the subject matter being incorporated in "Inventions and Their Protection."

Mr. Woodling has written his new book in thoroughly understandable language and has indexed the principal topics under 223 headings for ready reference.

Every engineer and designer should have a copy of this book on his desk, in order that he may be thoroughly familiar with laws and procedure governing protection of his ideas. A careful study of chapter headings will prove its value in everyday work.

Orders are now being received for delivery as soon as the book is off the press, in January. Requests will be filled in order of their receipt.

MACHINE DESIGN

CLEVELAND

Smooth as a SILK STOCKING

ROPER PUMPS

FOR METAL WORKING MACHINES

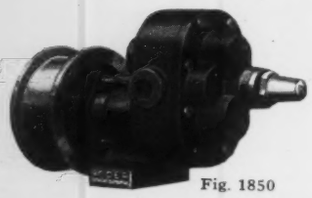


Fig. 1850

Roper Non-Pulsating Coolant Pumps handle cutting compounds and lubricating fluids with unbelievable smoothness . . . yet there is abundant power to supply the deepest bores and cuts. Guaranteed not to lose prime . . . high or low pressure, delivering 1 to 20 G. P. M.

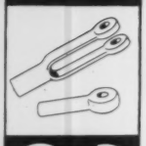
For smooth, uninterrupted service, Roper is the answer . . . dependable since 1857.

Write for Bulletin R4MD.

GEO. D. ROPER CORP., ROCKFORD, ILL.

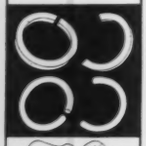
SPRING WASHERS

Spring washers and lock washers of every type and size, including the well-known Hipower and Kantlink types. There are thousands of more places where spring washers would improve the value of any product where bolts, nuts, cap or machine screws are used.



STEEL ROD ENDS

Drop forgings including steel rod ends of the adjustable yoke, plain yoke, and eye types. These articles in standard sizes and threads afford tremendous savings over special designs.



RETAINING RINGS

Spring retaining rings of special heat-treated spring steel are carried in many stock sizes—both open and closed types. Use of a spring retaining ring is an excellent manner of creating a shoulder on a shaft.

CONTAINER HANDLES

Forged steel handles for heavy containers—can be rigidly welded, riveted or attached by a strap to lie flat when not in use. Rugged and most satisfactory for hard usage.

STEEL BARREL CLOSURES

Forged and machined fittings for steel barrels, drums, tanks and metal packages, including plugs, rings and flanges. Very rugged for use in transportation of alcohol, turpentine, oils and other expensive liquids.

RHEOSTATS—RESISTORS—LOAD BOXES AND SPECIAL APPARATUS

Our electrical division—Hardwick, Hindle, Inc.—makes as fine electrical resistance products, fixed and variable, as can be devised.

* * * * * *

Other products include windows for buses and railway cars, railway car window curtains, curtain rollers and fixtures, sash locks and lifts.

THE NATIONAL LOCK WASHER COMPANY

NEWARK, N. J.—EXPORT DIV., 15 E. 26 ST., N. Y. C.

Professional Viewpoints

(*Concluded from Page* 57)

making of inventions and to the putting them to practical use.

—GEORGE H. GIBSON
New York

Likes Stress Analysis Article

To the Editor:

PLEASE accept my congratulations upon the article "Stress Analysis Is Simplified by New Method," written by K. E. Bisshopp, which appeared in your August issue. It is seldom that a technical magazine publishes so rigorous an analysis, which is a valuable and practical tool in design of machinery.

It so happens that I worked with Mr. Bisshopp for a number of years with Fairbanks, Morse & Co. Mr. Bisshopp is one of a bare handful of individuals who combine creative mathematical ability with practical engineering common sense. Such contributions as any of this group may choose to make to engineering literature are too valuable to be condensed to convenient space limits, as is feasible with ordinary descriptive articles. It is, therefore, regrettable that the article in question bears evidence of having been subjected to some such space squeezing.

It is the object of this letter, first, to compliment the author and the editorial staff of MACHINE DESIGN on the article as a whole; and second, to protest any condensation of articles of this type and importance. For example, the section "Numerical Evaluation of Z" describes a method of calculation obvious enough to mathematicians but little known and used by most engineers, to whom it should be a valuable weapon in many practical cases. In my opinion, it should form the subject of a future detailed article and full explanation, whether by the present author or by another equally competent.

—R. E. BRUCKNER

Spring Article Still in Demand

To the Editor:

WE NOTICE in the May, June, July and August, 1930, issues of MACHINE DESIGN a series of articles entitled "General Considerations in Designing Mechanical Springs" by A. M. Wahl. Will you kindly advise us by return mail the cost of photostating these articles from your bound volume so that we can have copies for our engineering library.

—J. W. INNES
Mall Tool Co.

EDITOR'S NOTE—Requests for this series of articles published seven years ago have exhausted more than a thousand reprints. To answer the demand, which still continues, and also to bring the articles up to date, MACHINE DESIGN will publish a similar series soon.

MANUFACTURERS' PUBLICATIONS

ALLOYS (STEEL)—Many applications of Silcrome stainless steel are illustrated and explained in a booklet just issued by Ludlum Steel Co., Watervliet, N. Y. Another booklet prepared by the company gives information on the working of Silcrome steel.

ASBESTOS—Packing for machine parts is one of many asbestos products described in the 64-page 1937-38 edition of the industrial products catalog released by Johns-Manville Sales Corp., 22 East 40th street, New York City.

BEARINGS—Typical applications of ball, roller and thrust bearings in the lumber and woodworking machine fields are shown in blueprint cross section in a 24-page booklet of Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS—Norma-Hoffman Bearings Corp., Stamford, Conn., has just issued an 84-page catalog, No. F-958, describing its complete line of ball, roller and thrust bearings. Bearings developed for special applications are included.

BERYLLIUM—Properties, uses and heat treatment data of beryllium copper castings are given in a bulletin just issued by The Beryllium Corporation of Pennsylvania, Reading, Pa.

CHAINS—Single chain conveyor made by Baldwin-Duckworth Chain Corp., Springfield, Mass., is described in bulletin No. 61 issued by the company.

CONTROLLERS—General line of thermostatic controls for all types of heating equipment, automatic stokers, warm air controls, etc. is described in a 50-page booklet of the Spencer Thermostat Co., 34 Forest street, Attleboro, Mass.

CONTROLS (ELECTRICAL)—Three bulletins have recently been issued by the General Electric Co., Schenectady, N. Y., describing electrical equipment made by the company. Bulletin GEA-1285A gives data on a new track-type limit switch; bulletin GEA-2443A gives construction data and ratings on the recently developed three-shoe, direct current, magnetic brake. Alternating current contactor is described in bulletin GEA-2577.

CONTROLS (ELECTRICAL)—The Ohio Electric Mfg. Co., 5901 Maurice avenue, Cleveland, has issued bulletin No. 110 describing its improved lifting magnets and magnet controllers.

COUPLINGS—Pamphlet describing the new Celoron flexible coupling made by the Continental-Diamond Fibre Co., Newark, Del., has been released by the company.

ELECTRONIC EQUIPMENT—Bulletin No. 70 pre-

His hydraulic presses are old. The packings leak badly. Shut-downs are frequent — and expensive. For a very good reason he does not want to spend a lot of money on reconditioning. He asks —

Give us two more months of life

After that he will get completely new equipment. But meanwhile, he needs a temporary way to keep his presses working. G & K engineers check the conditions — recommend a slight change in the packing design, and the addition of a specially-made heavy leather washer.

Our recommendations are accepted. The presses are now steadily working without any loss of time for packing replacements or adjustments.

At the Packing Point*, turn your problem over to the Home of Research. G & K engineers, working with specially-tanned leathers which resist heat, water, oil, semi-corrosive liquids, etc., can help you avoid packing troubles.

Our pamphlet on Hydraulic and Pneumatic packings will be sent on request.

**The vital point in any machine using packings. Consult Graton & Knight "X-Ray Thinking" while the machine is in the design stage and save time later on.*

Graton and Knight
HOME of RESEARCH
WORCESTER, MASS.
"X-Ray Thinking" at the Packing Point

Specify
MOTORPUMPS
—for Economy

—flexible in installation

—save expensive power take-off

3 sizes of
GEARED MOTORPUMPS

Nos. 101, 102 & 103, for horizontal or vertical mounting. Ask for complete data. Brown & Sharpe Mfg. Co., Providence, R. I.

BROWN & SHARPE
PUMPS
B·S

Courtesy of Curtiss Aeroplane Division

• aircraft precision

"... without using these shims it would be practically impossible to adjust gear assemblies to the close limit required." This Curtiss tribute to LAMINUM shims is based upon a score of applications from propeller to tail chassis! Write for Laminum sample ... either .002 or .003 in. laminations.

LAMINATED SHIM CO., INC. 21-26 44th Ave., Long Island City, N. Y.
CLEVELAND DETROIT MILWAUKEE
930

LAMINUM
Precision adjustment SHIMS

pared by Electronic Control Corp., 2666 East Grand Blvd., Detroit, gives data on an improved light relay and such accessories as photoelectric cell housing, optical slit light source and cable extensions.

FASTENINGS—Leaflet prepared by Standard Pressed Steel Co., Jenkintown, Pa., describes the new self-locking hollow set screw developed by the company.

FIBER—Micabond catalog issued by Continental-Diamond Fibre Co., Newark, Del., gives information on forms, properties and applications of the material.

FINISHES—Two leaflets have been made available by Roxalin Flexible Lacquer Co., Inc., Elizabeth, N. J., describing two new finishes developed by the company. Blue Knight Roxyn C is a chemical resistant finish and Cadmium water dip lacquer No. 3850 has high resistance to spots and tarnish.

FINISHES—Porcelain Enamel Institute, 612 North Michigan avenue, Chicago, has issued a handbook, "Production of Castings for Porcelain Enameling," which includes illustrations showing improper and proper design for castings and the influence of design in porcelain enameling.

GEARS—Twenty-five new sizes of nonmetallic motor pinions are listed in a folder of Boston Gear Works, Inc., North Quincy, Mass.

HARD FACING—More complete edition of the booklet, "Hard-Facing with Haynes Stellite Products," describing over 500 applications of the hard-facing progress has been issued by Haynes Stellite Co., Kokomo, Ind., a unit of Union Carbide and Carbon Corp.

HYDRAULIC EQUIPMENT—Various types of pumps and hydraulic motors are described in bulletin 47000 issued by The Oilgear Co., Milwaukee. Included in the 64-page booklet are application photographs and general information on this hydraulic equipment.

PACKING AND PACKING GLANDS—A 24-page bulletin has been issued by The Chicago Rawhide Mfg. Co., 1301 Elston avenue, Chicago, showing applications and giving specifications of oil seals made by the company.

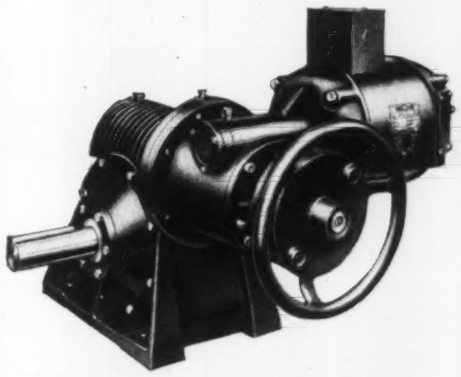
PLASTICS—Well-illustrated handbook showing types of materials that can be molded from Resinox powders and giving a brief outline on mold design has been issued by Resinox Corp., 230 Park avenue, New York City.

SHIMS—Detailed specifications of laminated brass shim stock, so compiled as to give essential information at a glance, is contained in a specifications file folder issued by Laminated Shim Co., Long Island City, N. Y.

VIBRATION DAMPENING—Products used for reducing vibration are described and typical applications presented in a booklet released by The Korfund Co., Inc., 48-15 Thirty Second Place, Long Island City, N. Y.

Janette
MOTORIZED SPEED REDUCERS

A PRECISION BUILT LINE OF
16 DIFFERENT TYPES
OF MOTORIZED SPEED REDUCERS,
1/50th to 7-1/2 H. P.



Illustrating a motorized speed reducer built specially for combustion control apparatus.

The diversity of the Janette custom built line of motorized speed reducers enables us to supply a machine for almost any purpose. Let our engineers help in selecting the right type for your application.

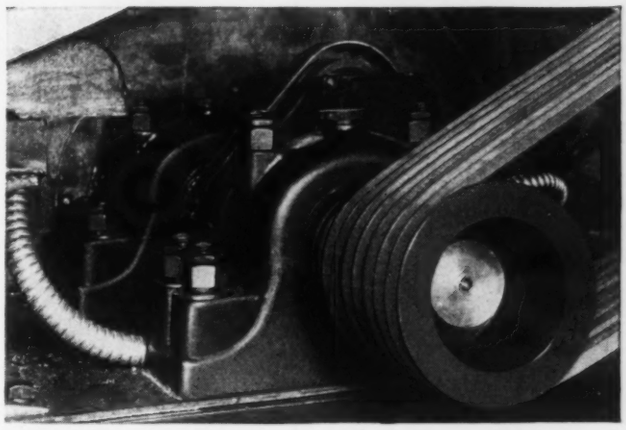
Rotary Converters—Generators—Motors—Motor-Generators

Janette Manufacturing Company
556-558 West Monroe Street Chicago, Ill. U.S.A.
BOSTON - NEW YORK - PHILADELPHIA - CLEVELAND - MILWAUKEE - LOS ANGELES
DETROIT - SEATTLE

YOUR

associate engineers are hired, not because they can draw lines, but rather because they can think. They assist you and your company in solving the multitude of problems arising in the design and redesign of your machines. ¶ The more they are assisted in their thinking, the more they will be able to think clearly and produce well-planned, well-designed units. ¶ MACHINE DESIGN, if judiciously routed or passed among your own department personnel, will assist them to think clearly on the problem at hand. Help your own associates to better themselves and your company by joining the other 25,000 *readers* of this and every succeeding issue of MACHINE DESIGN.

They're Rugged!



Dodge-Timken Bearings
PROTECT YOUR REPUTATION

That steady, severe service that bearings are bound to encounter "weeds" out the weaklings and brings out the leaders. That is why Dodge-Timken Bearings are widely preferred by machine designers as rugged aids to the uninterrupted performance of the entire unit. Designed and built to insure satisfactory performance under every service condition, these famous bearings protect your good name and reputation. Specify *Dodge*. There's more than half a century of success behind that name.

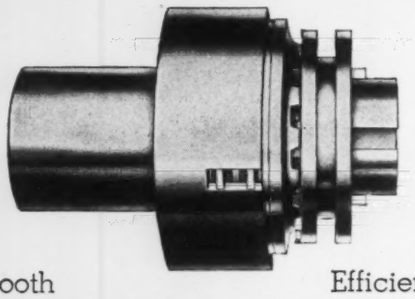
Let us send you a copy of our bulletin A-206 which describes Dodge Rolling Bearings.

DODGE MANUFACTURING CORPORATION
MISHAWAKA, INDIANA U. S. A.

THE Right DRIVE FOR EVERY JOB

DODGE
MISHAWAKA
THERE IS ADDED VALUE IN THE NAME DODGE

CONWAY Sleeve Clutch



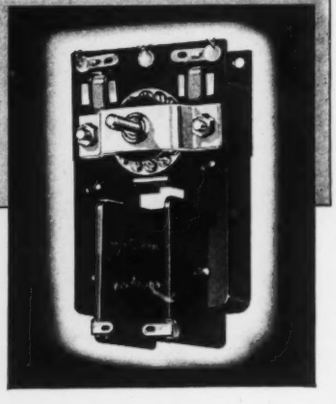
Smooth Efficient

Alert engineers select the Conway XYZ Clutch because it embodies full floating plates, high ratio leverage, easy engagement, instant release and free idling. Moreover, it is also built to operate double throw.

Write for full details covering this exceptional unit designed for restricted swing radii and fractional horsepowers. BULLETIN XYZ.

THE CONWAY CLUTCH CO.
1546 Queen City Avenue
CINCINNATI, OHIO

A MINIATURE REVERSIBLE Powerplant



Featuring:
Compact Power
Positive Control
Universal Application

Unusually high starting torque in both directions is now obtainable in this new midget motor.

Dynamic braking and reversal of rotation are easily accomplished by simply switching in a low voltage circuit.

Recent developments make it possible to announce the addition of small gear reduction assemblies, integral with the motor, enormously extending the range of applications.

Both reversible and unidirectional models may now be mounted in any position, with or without speed reduction assemblies.

For additional information address your inquiries to

THE ALLIANCE MANUFACTURING CO.
South Mahoning Ave. Alliance, Ohio

Business and Sales Briefs . . . . . .

NEW appointments of Cutler-Hammer Inc., Milwaukee, included that of A. R. Johnson as manager of the merchandising sales division, Milwaukee, and E. T. Reese as manager of the branch office at 307 North Pennsylvania avenue, Indianapolis.

* * *

John McC. Latimer has become district sales manager in the Pittsburgh territory for Lukenweld Inc., division of Lukens Steel Co., Coatesville, Pa.

* * *

Cincinnati offices of the Emerson Electric Mfg. Co., St. Louis, will be at the following new address: 457 East Sixth street, Jack Searls will continue in charge.

* * *

Charles H. McKnight, previously with General Electric Co., has become associated with Allegheny Steel Co., Brakenridge, Pa., as special sales representative.

* * *

Associated with the Acme Steel Co., Chicago for 17 years, C. A. Carrell has been named sales representative in Georgia, with offices at Atlanta.

* * *

Irwin P. Rieger has been appointed district manager of sales in the Chicago district for the Standard Tube Co., Detroit, with headquarters at 326 West Madison avenue, Chicago.

* * *

Formerly general manager of sales, Vanadium Corp. of America, New York, Gustav Laub has become assistant vice president and general manager of sales of the company.

* * *

An aeronautical engineer with long experience in the design, manufacture and operation of lighter and heavier-than-air craft, Herbert V. Thaden has been appointed sales engineer in the stainless steel division of Carnegie-Illinois Steel Corp., Pittsburgh. He will devote his efforts to the technical and business development of stainless steel products for aircraft use.

* * *

Vacuum Systems Inc., with executive offices at 436 The Arcade, Cleveland, has been incorporated, acquiring the assets of the Crescent Pump Co., Detroit, former manufacturers of the Crescent roto-piston dry vacuum pump. The new organization is now in readiness to serve previously sold equipment, furnish parts, manufacture new pumps and accessories, fittings and all special tools and parts for special work. Louis H. Mesker is president of the company.

* * *

According to a recent announcement of Albert Miesem, director of sales of Roxalin Flexible Lacquer Co. Inc., Elizabeth, N. J., Robert K. Hungerford, representative of the company in New England for the past 12 years, has been appointed to assist him, with

VIBRATION LICKED AT LAST

THE WINNER
— and New Champion

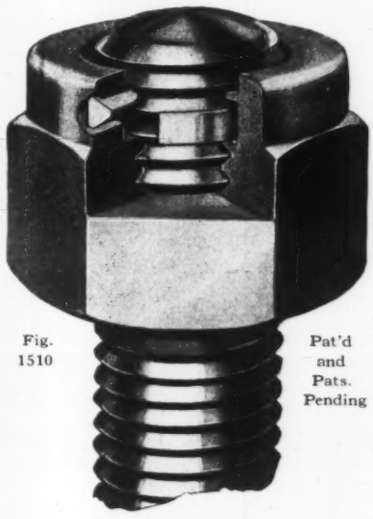


Fig. 1510

Pat'd and Pats. Pending

Cutout section shows the Locking Ring in position.

IT JUST CAN'T LOOSEN THE

UNSHAKO

SELF-LOCKING NUT

The Built-in Locking Ring holds the nut tight against all conditions

Machines that have been regularly shaking loose from nuts intended to hold them tight are licked when the "Unshako" is applied. By working on the brake band principle the integral self-locking ring causes the nut to stay put whenever vibration tries to shake it loose. Yet the nut turns down easily and backs off easily, too, with just the help of a regular wrench. "Unshako" has no separate pins, washers or other gadgets to bother with.

If vibration is an old time enemy of yours, here's your best bet—send for the facts about "Unshako".

STANDARD PRESSED STEEL CO.

BRANCHES BOSTON DETROIT INDIANAPOLIS

JENKINTOWN, PENNA.

BOX 102

BRANCHES CHICAGO ST. LOUIS SAN FRANCISCO

POSITIONS

AVAILABLE OR WANTED

NEW Product. Designer of several successful diesel engines seeks connection with firm desiring new product. Will design improved small bore, high speed engine for growing special markets for reasonable salary and bonus. No great capital investment required for first engine. Address Box 111, MACHINE DESIGN, Penton Building, Cleveland, Ohio.

WANTED: Sales Engineers or manufacturers' agents in several large industrial centers to represent an old-established company producing machine parts sold to machinery manufacturers. Must be technically trained. Give particulars as to lines handled and territory now covered. Address Box 112, MACHINE DESIGN, Penton Building, Cleveland, Ohio.

CLASSIFIED advertisements are set in eight point Stymie bold face type, approximately eight words to a line. Rates are as follows:

Positions Available—20c a word, with a minimum charge of $10.00, which permits the use of fifty words.

Positions Wanted—10c a word, with a minimum charge of $3.00, which permits the use of thirty words.

The box number will be counted as one line or eight words.

Ten different models and many different sizes in each model. All models feature the famous Gits unbreakable clear sight bottle. Plenty oil—yet no over-oiling.

GITS BROS MANUFACTURING CO.
1861 S. KILBOURN AVE., CHICAGO